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# DISTRIBUTION AND HOST IDENTIFICATION OF EPIPHYTIC PLANT, *Hydnophytum formicarum* Jack, IN PULAU TELAGA TUJUH, SETIU, TERENGGANU

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**Abstract:** The aim of this study was to describe the abundance of *Hyndophytum formicarum* and the characteristics of its host in Pulau Telaga Tujuh, Setiu, Terengganu. A transect line of 200 meters were set up across the island and further divided into four plots. The occurrence of *H. formicarum* individuals were counted in each plot. Host plants were identified, their bark structures and stem diameter were recorded. We also identified and noted other vascular epiphytes that co-occur with *H. formicarum*. A total of 3,996 individuals of *H. formicarum* were quantified, while 345 hosts from 15 different species were recorded. *Heritiera littoralis* is the most frequent host with 91 occurrences in the plots. Fissured bark structures is the most preferred by *H. formicarum* when 9 out of 15 host species possessed this character. Majority of the host (175 trees) have a DBH size ranging from 10-19.9 cm. *Dischidia nummularia* was found to be the most frequently co-occurred with *H. formicarum* with 143 occurrences. This study concludes that *H. formicarum* is not a host-specific species. However, the high abundance of this species at Pulau Telaga Tujuh should be studied thoroughly considering the increased of habitat alteration in the area.

Keywords: Ant-plant, abundance, phorophytes, epiphyte ecology, mangrove, Setiu Wetlands.

## Introduction

Epiphytes which are wide in varieties and diverse is a major component in rainforest as they play role in productivity, creating microhabitats for some unique animals and not to mention able to hold nutrients and constituted biomass. Epiphytes are widely distributed throughout the globe and concentrated in the tropical rainforest and temperate rainforest with Bromeliaceae peaked as the most diverse group.

Most epiphytic plants distributed in clump, gregarious or random pattern (Madison, 1979) where their distributions were affected by seed dispersal, mostly by wind or animals pollinators. Host trees played a vital role for epiphytic plant existence where they will need to survive and fight for sunlight and nutrients minerals from the atmosphere in the same time not significantly harming the hosts. The abundance of epiphytic plants was affected by host species characteristics and abundance of other epiphytic species (Brown, 1990).

*Hydnophytum formicarum* is an epiphytic plant of Rubiaceae family and also identified as myrmecophyte due to its association with ants where ants inhabit their caudex for protection and shelter (Huxley, 1978). This species can be found distributed throughout South East Asia, Melanesian archipelagos and the far north Australia (Huxley & Jebb, 1991). Extensive studies have been done on the screening of the medicinal values for *H. formicarum* particularly on cancer treatment alternative (e.g. Darwis *et al*., 2014; Senawong *et al*., 2013). Besides that, this species was also found to be effective in treating headache, rheumatism and diarrhea, as it contains bioactive compound (Prachayasittikul *et al*., 2008). *Hydnophytum formicarum* was declared as nationally critically endangered in Singapore (Lok & Tan, 2009), hence, conservation effort on the same species in Malaysia is crucial. The scarcity of information and current literatures on this species particularly on its ecology and biological aspects have driven this study to be conducted.

Pulau Telaga Tujuh located in the lagoon of the Setiu Wetlands, Terengganu, was known harboring quite a substantial number of *H. formicarum*, which provides an opportunity to study more about the species. This study was aimed to identify the characteristics of the hosts for *H. formicarum* in Pulau Telaga Tujuh, Setiu.

## Materials and Methods

### *Sampling*

Pulau Telaga Tujuh in Setiu (N 05˚41'47.5" and E 102˚ 41'46.3") is one of the many islets in Setiu lagoon with mangroves as a major vegetation type (Figure 1). The islet measured 847 meter long from one end to another and ranged about 45 meter to 102 meter wide. A 200 meter transect line were set up using measuring tape along the island starting from the south most end of the island and partitioned into four plots of 50 m long each. Each plot was further divided into its west and east side.

### *Host Trees Abundance and Characteristics*

*H. formicarum* individuals and their hosts were counted in each plot. Host's characteristics such as bark structures and stem diameter were observed and measured respectively. The host trees were divided into six DBH classes; 5-9.9 cm, 10-19.9 cm, 20-29.9 cm, 30-39.9 cm, 40-49.9 cm and 50-59.9 cm. Other vascular epiphytic plants that occur on the similar hosts with *H. formicarum* were also identified and the frequency of co-occurrence was calculated.

## Results and Discussion

### *Hydnophytum Formicarum Abundance and Distribution*

A total number of 3,996 individuals of *H. formicarum* were recorded distributed throughout 200 meters of sampling site (Table 1). Plot 4 showed the most number of *H. formicarum* individuals with 2,452 (61.36%). Meanwhile the Plot 1, which located at the tip of the islet, resulted the least number of individuals. This is probably due to the vegetation type that consisting of *Ipomoea* sp. and *Pandanus* sp. bushes which are not suitable to host *H. formicarum*. Besides that, geographical factor such as anthills, small streams and bushes might have caused patchiness in distribution in Plot 1. It was also observed that the number

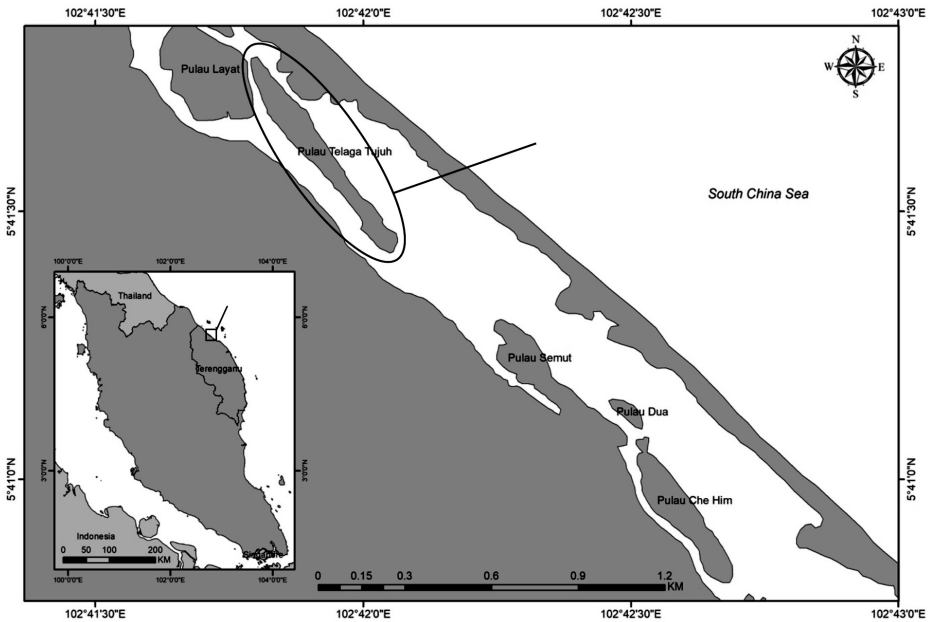


Figure 1: Map shows the location of study site, Pulau Telaga Tujuh in Setiu Wetland, Terengganu

of individuals of *H. formicarum* is increasing starting from the first plot towards the fourth plot. This abundance pattern is parallel with the increased in the number of the host species as we progressed further into the island to Plot 2 and the next plots.

The species was found distributed in clumped pattern. Wind dispersed seed are more likely to remain close to the parental plant (Malanson & Armstong, 1996). The growth of epiphyte mostly closer to the juvenile plant (VanDunne, 2002) and this plant in particular tend to accumulate resources and another individual will grow clumping around the resources.

### *Host Abundance and Characteristics*

The abundance of hosts varied significantly in this study, with *Heritiera littoralis* showed as the most favourable host (91 individuals), while *Thespesia populnea*, *Clerodendrum inerme* and *Memecyclon edule* were found least favour by *H. formicarum* (Table 2). However, there is no clear indication on the host preference for this species in Pulau Telaga Tujuh, which parallel with the observation by Yang *et al*.,

Table 1: Number of individuals of *Hydnophytum formicarum* in Plot 1-4 in Pulau Telaga Tujuh, Setiu, Terengganu

| Plot | Number of Individuals | Percentage (%) |
|---|---|---|
| 1 | 60 | 1.5 |
| 2 | 218 | 5.46 |
| 3 | 1266 | 31.68 |
| 4 | 2452 | 61.36 |
| Total | 3996 | 100 |

Table 2: The abundance of host trees in Pulau Telaga Tujuh, Setiu, Terengganu

| Host Species | Family | No. of Individuals | Relative Abundance (%) |
|---|---|---|---|
| *Heritiera littoralis* | Sterculiaceae | 91 | 26.38 |
| *Rhizophora apiculata* | Rhizophoraceae | 78 | 22.61 |
| *Xylocarpus granatum* | Meliaceae | 52 | 15.07 |
| *Excoecaria agallocha* | Euphorbiaceae | 47 | 13.62 |
| *Ceriops zippeliana* | Rhizophoraceae | 27 | 7.83 |
| *Hibiscus tiliaceus* | Malvaceae | 14 | 4.06 |
| *Bruguiera cylindrica* | Rhizophoraceae | 11 | 3.19 |
| *Bruguiera gymnorrhiza* | Rhizophoraceae | 9 | 2.61 |
| *Pouteria obovata* | Sapotaceae | 5 | 1.45 |
| *Casuarina equisetifolia* | Casuarinaceae | 4 | 1.16 |
| *Ximenia americana* | Olacaceae | 2 | 0.58 |
| *Intsia bijuga* | Fabaceae | 2 | 0.58 |
| *Thespesia populnea* | Malvaceae | 1 | 0.29 |
| *Clerodendrum inerme* | Verbenaceae | 1 | 0.29 |
| *Memecyclon edule* | Melastomataceae | 1 | 0.29 |

(2011) that reported a frequent occurrence of *H. formicarum* on *Lumnitzera littorea* and *Rhizophora apiculata* in the mangrove forest of Pulau Pawai, Singapore. It was assumed that the specificity of the host trees could be resulted from the trade-offs between adaptations that allow organisms to cope with the environment and allow the exploitation of the resources available (Wagner *et al*., 2015).

Few studies suggested that most of the trees that favoured by epiphytes showed a rough and fissured bark (Brown 1990; Oloyede *et al*., 2014). This is parallel to our result when majority of the hosts for *H. formicarum* possess fissured and scaly bark (Table 3). Meanwhile, population of *H. formicarum* in Singapore was found preferred a rough bark structure (Yang *et al*., 2011). However, study in Singapore did not mention the bark characters in details, thus limiting the comparison. Observation made by Wyse and Burns (2011) revealed that the abundance of epiphytes varies on different host species with different bark structures from one to another. For instance, high abundance of epiphytes recorded on rough and stable surface of *Vitex lucens* and epiphytes also found on smooth bark with mosses association where the mosses on the bark functions to trap the nutrients and provide water retention.

*H. formicarum* in Pulau Telaga Tujuh was found abundantly on the small-sized trees (DBH range 2 cm – 19.99 cm) (Figure 3) even though the size of host tree were suggested to have a close relation to the abundance of epiphyte (Sáyago *et al*., 2015). This is due to the vegetation type in the study area, which mostly young mangrove trees that rarely grow bigger than 60 cm in size. *Xylocarpus granatum* was identified to be the largest host tree with total diameter of 58 cm while *Ceriops zippeliana* was the smallest with diameter of 2 cm.

Table 3: Bark characteristics of host trees for *Hydnophytum formicarum* in Pulau Telaga Tujuh, Setiu.

**Fi** = fissured, **C** = cracked, **Sc** = scaly, **Sm** = smooth, **L** = lenticellate, **Fl** = flaky, **D** = dippled

| **Host Species** | **Bark Types** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Fi** | **C** | **Sc** | **Sm** | **L** | **Fl** | **D** |
| *Rhizophora apiculata* | / | | / | | | | |
| *Ceriops zippeliana* | / | | / | | / | / | |
| *Bruguiera gymnorrhiza* | / | | | | | | |
| *Bruguiera cylindrica* | | / | | | | | |
| *Hibiscus tiliaceus* | | | | / | / | | |
| *Thespesia populnea* | / | | / | | / | | |
| *Heritiera littoralis* | / | | / | | / | | |
| *Xylocarpus granatum* | | | | / | | / | / |
| *Excoecaria agallocha* | / | | | | | | |
| *Pouteria obovata* | | / | / | | | / | |
| *Casuarina equisetifolia* | / | / | | | | | |
| *Ximenia americana* | | / | / | / | | | |
| *Intsia bijuga* | | | | / | / | | |
| *Clerodendrum inerme* | / | | / | | | | |
| *Memecyclon edule* | / | | | | | | |

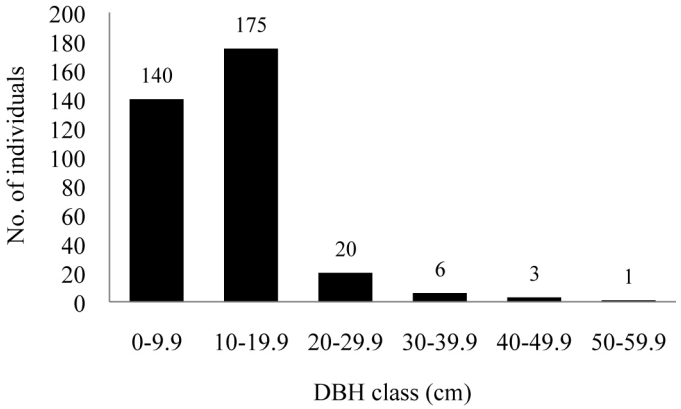


Figure 3: The distribution of host tree according to DBH

Table 4: List of other epiphytic species that co-occur with *H. formicarum* in Pulau Telaga Tujuh, Setiu

| Species | Family | No. of Individuals |
|---|---|---|
| *Dischidia nummularia* | Asclepiadaceae | 143 |
| *Dalbergia candenatensis* | Fabaceae | 80 |
| *Myrmecodia tuberosa* | Rubiaceae | 17 |
| *Pyrrosia piloselloides* | Polypodiaceae | 70 |
| *Drynaria quercifolia* | Polypodiaceae | 8 |
| *Phymatosorus cuspidatus* | Polypodiaceae | 2 |
| *Taeniophyllum obtusum* | Orchidaceae | 50 |
| *Dendrobium crumenatum* | Orchidaceae | 22 |
| *Hoya verticillata* | Asclepiadaceae | 10 |
| *Thrixspermum sp.* | Orchidaceae | 6 |
| *Hoya coronaria* | Asclepiadaceae | 4 |

### *Associated Epiphytic Plant Species*

There are a total number of 11 species of vascular epiphytic plants that was found co-occur with *H. formicarum*. *Dischidia nummularia* was identified as the most occurring associate species. The thick humus in the substrate of epiphytic species is able to retain more water, hence providing moisture to other epiphytes to survive as an aerial plant on the same host (Jian *et al*., 2013). This probably true for *H. formicarum,* since we observed a substantial amount of plant litters trapped at the base of the caudex.

## Conclusion

We found a substantial number of individuals of *H. formicarum* in Pulau Telaga Tujuh that can be an indicator of a healthy mangrove. Even though the species is not host-specific, however, the species was found on the trees with rough bark surface. Considering the fact that *H. formicarum* is highly sought after for its medicinal properties, an active management should be taken to ensure the sustainability of this species. Therefore, the findings from this study are important in strategizing a better management plan for the conservation of the species.

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