

Searching for Nature Stories (Learning and Practising Nature Exploration)

Title: The ecological niche of *Lemmaphyllum microphyllum*  
(epiphytic fern)

School: Pope Paul VI College

(Group 28)

Members: Cheng Tsz Ying  
Lau Hiu Ting  
Kwok Pui Shan  
Yip Sze Tung

Adviser: Miss LEE Lai Ping Goretti

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## **1. Abstract**

Epiphytic ferns are commonly found in Hong Kong. However, many people may have misunderstandings on epiphytic ferns. They think that epiphytic ferns may bring harmful effects to the substratum and the host plants. Some people even know nothing about them. Therefore, from this investigation, we want to know their effects on their habitat and their host plants. Besides, we want to know the factors affecting their growth.

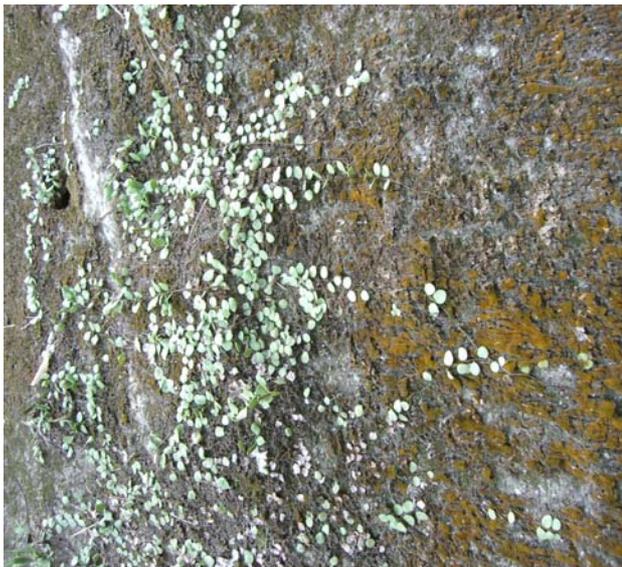
## **2. Biological principle and purpose of the investigation**

Hong Kong has a rather rich fern flora because of its diversity of habitats. We can find ferns in forests, streams, mangroves, grasslands, rocky hillsides, shaded ravines and even deserts. However, ferns are frequently overshadowed by many eye-catching flowers, so many people may neglect them. In fact, ferns play a significant role in the ecosystem.

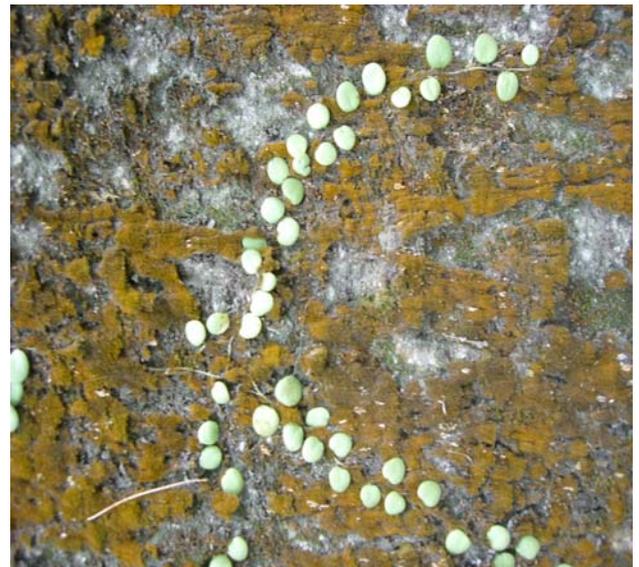
Ferns belong to a group of non-flowering vascular plants which produce spores on sporangia borne on the lower surface or edge of their leaves. There are different types of ferns, including terrestrial sun ferns, terrestrial shade ferns, climbing ferns, epiphytic ferns and epilithic ferns. Our investigation focuses on epiphytic ferns.

An **epiphytic fern** is a type of fern that grows upon or attached to a rock or tree. Epiphytic plants are sometimes called "air plants" because they do not root in soil. These make up 20 per cent of the total fern species. *Lemmaphyllum* and *Pyrrhosia* species are examples of epiphytic ferns. Many large trees in the peak area are totally enveloped by epiphytic ferns like a green coat, will this cause harm to their substratum?

To investigate this problem, we chose *Lemmaphyllum microphyllum* as the target. We first choose specific habitat in Tai Po Kau Natural Trail where the target plant grows for observation. Then, we studied the factors affecting its growth in order to find out their relationship with the environment.



**Fig. 2.1** *Lemmaphyllum microphyllum*



**Fig 2.2** *Lemmaphyllum microphyllum*

## 2.2 Objectives

- (1) To study the relationship between the epiphytic fern *Lemmaphyllum microphyllum* and the trees that they grow on and its effect on their substratum.
- (2) To study effect of light intensity and human impacts on the growth of *Lemmaphyllum microphyllum*

## 2.3 Hypothesis

- (1) Epiphytic ferns can live on rocks or tree branches. Ferns that live on trees may not be parasitic or semi-parasitic on the host plants because they just merely attach themselves on the surface by the rhizomes as shown in figures 2.3.1 to 2.3.4 and use them to absorb water dripping from the aerial leaves. Referring to figures 2.3.5 to 2.3.9 showing the ferns that live on rocks, they also just merely attach themselves on the surface by their rhizomes and cause no damage to the rock while the rock provides them with support.



**Fig 2.3.4:** *Lemmaphyllum microphyllum* on the rock



**Fig 2.3.5:** *Lemmaphyllum microphyllum* on the rock



**Fig 2.3.6:** *Lemmaphyllum microphyllum* on the



**Fig 2.3.7** *Lemmaphyllum microphyllum* on the rock



Higher light intensity facilitates the growth of epiphytic ferns because light is necessary for ferns to carry out photosynthesis.(figures 2.3.10 to 2.3.11)  
Human impacts may affect the physical condition of the ecosystem, and thus the light intensity.



**Fig 2.3.10** Area with sufficient sunlight



**Fig 2.3.11** Tree under sufficient sunlight

### 3. Method

#### 3.1 Outline of the investigation design

- (1) For investigating the effect of the epiphytic ferns on the trees and the rocks Particular rocks and trees that were partly attached by the epiphytic ferns were chosen. The textures between the part attached by the epiphytic ferns and the part without epiphytic ferns were compared. The structures of the epiphytic ferns (including their roots and rhizomes) were then examined.

The independent variable is the presence of the epiphytic ferns. The dependent variable is the texture of the rock and the tree. The controlled variables are temperature, humidity, and light intensity



**Fig 3.1.1:** *Lemmaphyllum microphyllum* on the rock

- (2) For investigating how the factors of light intensity and human impacts affect the growth of epiphytic ferns, a transect line was used to confine a particular range of the habitat for investigation.

The independent variable was the light intensity that was related to the relative amounts of human impacts in the habitat. Light intensity of various sites along the transect line was estimated by comparing the relative degree of shading and human impacts of each interval was studied and recorded

The dependent variable was the abundance (percentage coverage) of the epiphytic ferns in the quadrat. At regular 2-meter interval, the relative abundance of the epiphytic fern within a quadrat (0.5m x 0.5m)

The controlled variables were the temperature, relative humidity, wind etc. As the transect line was laid along the same direction and the data were collected on the same day, these variables could be assumed the same at various intervals along the transect line.

### **3.2 Apparatus and materials**

- |                               |                        |
|-------------------------------|------------------------|
| - transect line(x 1)          | - hygrometer (x 1)     |
| - quadrat (0.5m x 0.5m) (x 1) | - magnifying lens(x 1) |
| - spirit level (x 1)          | - 1-meter ruler (x 3)  |
| - thermometer (x 1)           | - shovel (x 1)         |
| - compass (x 1)               | -                      |

### **3.3 Procedure**

- (1) The effect of the epiphytic ferns on the rocks and trees was studied
- The epiphytic ferns growing on the surface of the branches and rocks were shoveled up.
  - The rhizomes of the ferns were studied to find out whether these structures had penetrated into the barks of the trees and rocks.

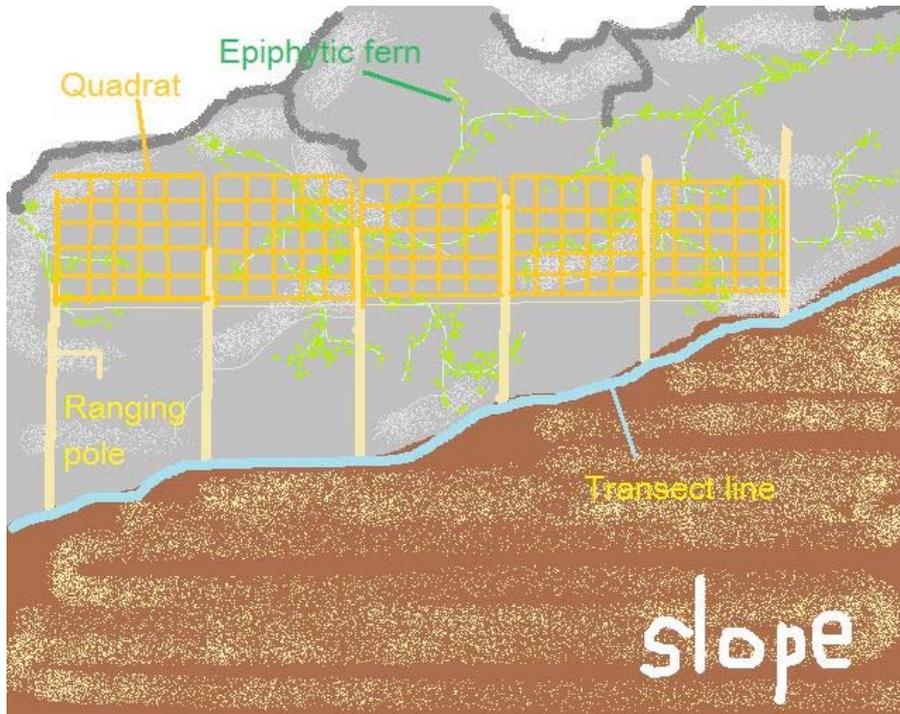


**Fig 3.3.1:** *Lemmaphyllum microphyllum* on the tree



**Fig 3.3.2:** *Lemmaphyllum microphyllum* on the tree

- (2) The factors affecting the growth of the epiphytic ferns were studied
- (a) Using a compass, a transect line (28m) was laid down on the ground along the same aspect in the chosen area for studying
  - (b) The quadrat was placed at 2m intervals along the transect line in turn, a total of 14 sites were studied.
  - (c) A spirit level and three 1-meter rulers were used to ensure the quadrat was placed at the same height at different sites. Thus the difference in the light intensity of study sites along the transect lines was not related to height but the degree of shading in the environment only.



**Fig 3.3.3:** A diagram which shows how the quadrat could be placed at the same height in different sites along the transect.

- (3) The percentage coverage of the epiphytic fern within the quadrat was measured by counting the number of grids covered by the ferns in proportion to the total number of grids. The percentage coverage was calculated.



**Fig 3.3.4:** A quadrat covered with *Lemmaphyllum microphyllum*

- (4) The relative light intensity of each study site was estimated by observing the relative degree of shading in the environment due to the presence of trees and rocks, etc.



**Fig 4.2.1:** A site with lower light intensity



**Fig 4.2.2:** A Site with higher light intensity



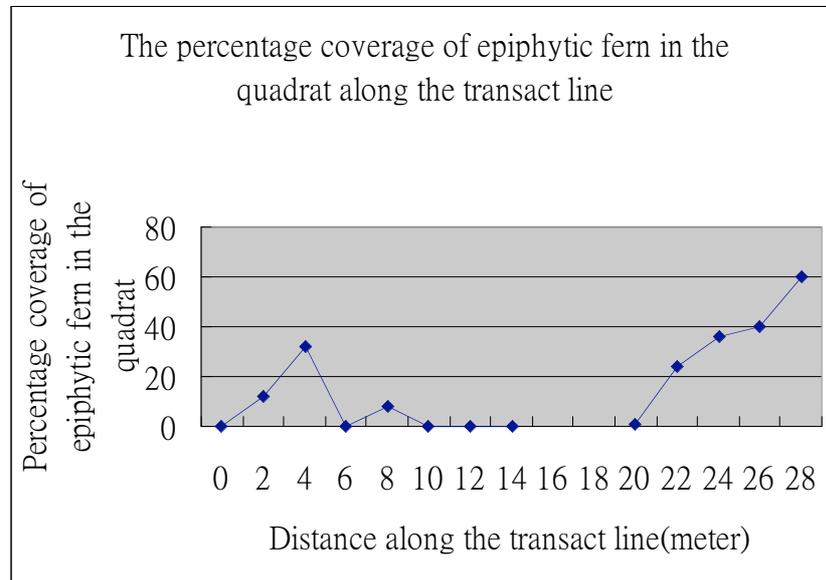
**Fig 4.2.3:** A tree with more shading



**Fig 4.2.4:** A tree with less shading

#### 4. Results

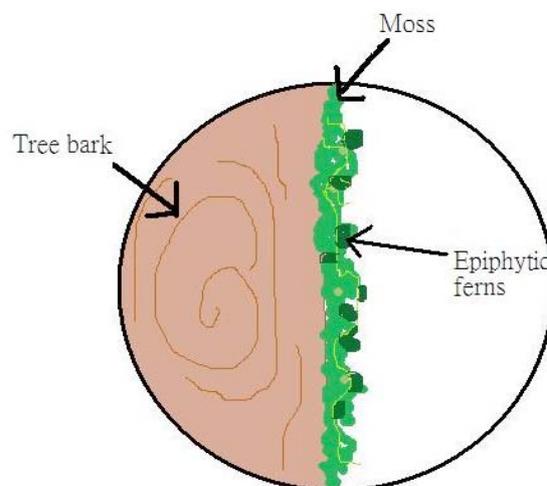
**Table 4.1:** The abundance in percentage coverage (%) of epiphytic ferns in different distance(meter) along the transect line



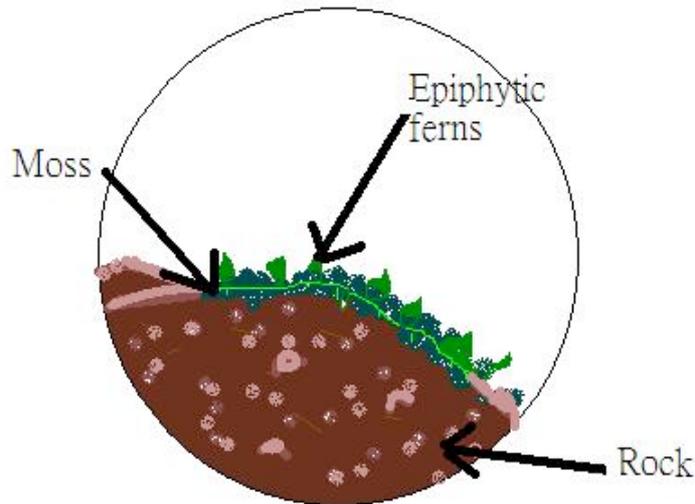
**Table 4.2:** The effect of the epiphytic fern (*Lemmaphyllum microphyllum*) on the rocks and trees

	Texture of the rock	Texture of the tree bark
With epiphytic ferns	Hard, bumpy	Hard, rough
Without epiphytic ferns	Hard, bumpy	Hard, rough

**Figure 4.2.5:** Drawing to show the growth of *Lemmaphyllum microphyllum* on the tree bark



**Figure 4.2.6:** Drawing to show the growth of *Lemmaphyllum microphyllum* on the



**Table 5.3** The abundance of epiphytic ferns in different environment

Meter(m)	Distance along the transect line (meter)													
	2	4	6	8	10	12	14	16	18	20	22	24	26	28
Environment (Key <sup>1</sup> )	S	S	S	S	S	S	S	G	G	S	T	T	T	T
Relative light intensity (Key <sup>2</sup> )	+++	+++	+	++	+	+	+	-	-	+	++	+++	+++	++++
Abundance of the epiphytic fern (% coverage)	12	32	0	8	0	0	0	-	-	1	24	36	40	60

Key<sup>1</sup>: S - man-made slope with little trees; G –grass; T - high density of trees

Key<sup>2</sup>: “5+” – highest light intensity; “+” – lowest light intensity-

## **5. Analysis and conclusion**

Parasitism means some organisms live on or inside other organisms, obtaining benefits from but causing harm to them. With reference to figures 4.2.5 and 4.2.6, the roots of the epiphytic fern, *Lemmaphyllum microphyllum*, were not penetrating into the barks of the host trees but just attaching themselves on the surface by their rhizomes, In fact, the fern grows with the mosses, lichens, and algae on the surface of the rock and the tree branches. Besides, with the presence of the epiphytic fern or not, there was no difference in the texture of the rock surface and tree barkso the epiphytic ferns living on the tree, were not parasitic or semi-parasitic

Trees provided shelter to the epiphytic fern, but the fern plants were not found giving any benefits to the trees studied despite being benefited from them through gaining anchorage. Therefore, relationship between the epiphytic fern and the

trees that they climb on was commensalism. The epiphytic fern was the commensal as it is benefited while the trees were the hosts as they were not affected.

As the growth of the epiphytic fern was affected by light intensity (abiotic factor), so it was affected by the growth of other plants as well as the human impacts on the physical condition of the ecosystem. Table 5.3 shows that the abundance of epiphytic fern was greater if there were more plants and trees in the environment such as at 22-28 meters along the transect line. This is because the plants and trees provide supports for the epiphytic fern to grow on. Human impacts were found to have affected the abundance of ferns as illustrated in tables 4.3, 4.4 and figure 4.5. Referred to tables 4.1 and 5.3 the abundance of the epiphytic fern was greater at 22-28 meter along the transect line because light intensity at these sites were higher. Thus ferns living in these sites could grow better. With higher the photosynthetic rate.

### **Limitation and sources of errors**

In this investigation, light intensity were not measure quantitatively, so the reliability of the results was affected. The measurement of percentage coverage of the fern plants may also be inaccurate.

### **Conclusion**

The relationship between the epiphytic fern *Lemmaphyllum microphyllum* and the trees that they climb on is commensalisms because trees provide substratum for epiphytic fern to grow. The fern does not harm their host trees nor damages the rock substratum. High light intensity and less man-made disturbance facilitate the growth of this epiphytic fern.

### **Significance of the findings and suggestions**

It seems that the epiphytic ferns enveloping large tree in the Peak area totally like a green coat on them would affect the growth of the trees and in turn affect the ecosystem. However, the findings of this investigation, show that the epiphytic ferns actually do not affect the growth of their host trees nor their environment either. These could rectify misunderstanding of many people about the functional role of the epiphytic ferns in the ecosystem.

The epiphytic fern *Lemmaphyllum microphyllum* is commonly found in Hong Kong as the subtropical climate favors its growth. It would be easy to plant this epiphytic fern in Hong Kong. Since this epiphytic fern is green and it does not affect the environment, we suggest that the government to plant more of this plant in the parks or uses it as environment ornament. This not only creates a green Hong Kong but also improves our air quality. In addition, this epiphytic fern is reported to have medical value. It has been used as a Chinese medicine for maintaining human's health, stopping coughing, etc. (So, 1994)

## **6. Bibliography**

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3. <http://en.wikipedia.org/wiki/Fern>
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## **Acknowledgement**

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