Abstract

Research title : The study of physical factors and bark surface characteristics affecting the diversity of lichen In the area of the nature study path of the Southern International Botanical Garden (Thung Khai)

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Level : Grade 10

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The proposes of this study were to study the relationship of physical characteristics associated with lichen diversity in the Southern Universal Botanical Garden (Thung Khai), as well as to explore the diversity of bark lichens for each species in the nature study route of the Southern Botanical Garden (Thung Khai), Yan Ta Khao District, Trang Province and to physical characteristics each tree bark skin included the number and type of lichens that indicated the diversity of lichen. The method of operation is to measure air quality according to the GLOBE method by measuring temperature. air relative humidity and light intensity, to study the bark surface characteristics and observe the diversity of lichen in the Southern Universal Botanical Garden (Thung Khai) Yan Ta Khao District, Trang Province. It was found that the factors that affected the diversity of lichen in the Southern Universal Botanical Garden (Thung Khai) were: air temperature, air relative humidity, light intensity and bark surface that affected the varieties of lichen. There are 3 groups of bark surface characteristics can be identified: scaly bark surface, 8 species of lichen , and smooth bark surface , 12 species of lichen and the appearance of the bark surface cracked, found the number of lichen 5 species of which some lichens can be found on the bark surface of all three groups. The total number of lichens found in the Southern Botanical Garden Universal Nature Trail (Thung Khai) totals 14 species, namely *Cryptothecia* sp. , *Dirinaria* sp. , *Pyxine cocoes , Trypethelium tropics , Amandinea extunate , Trypethelium eluteriae , Lecanora* sp. , Glyphis & Sacographa , *Arthonia* sp. *, Chrysothrix* sp. *, Graphid* sp. *, Anthracothecium* sp *. , Laurera benguelensis , Parmotrema tinctorum*

Keywords : lichen , bark texture physical factors Southern International Botanical Garden (Thung Khai)

Introduction

Lichen are organisms that have an interdependence between green algae and fungi. cyanobacteria and fungi , where green algae and cyanobacteria in lichen are known as photobiont ; and The fungus is called mycobiont , a fungus in lichen . Most of them are in the phylum ascomycota , with some species being fungi in the phylum basesidiomycota , called lichen . from these two phylums of fungi as ascolichen and basidiolichen , respectively , can be of three forms in the relationship between organisms in lichens . Types are 1) fungi and green algae, 2) fungi and cyanobacteria, and 3) fungi and green algae and cyanobacteria. green algae and cyanobacteria can create food through photosynthesis. The fungi are fed . Different types of lichen are not able to withstand different levels of pollution. Surveys of lichen diversity , both the type and number of lichens in the study area, can initially assess the air quality in those areas (Sornrat , 2010) . Growing, both the type and number of lichen will be related with species of wood habitats (Ozturk and Guvenc , 2010) , in which the bark accumulates various substances in the atmosphere and the trees themselves affect the organisms that using bark as a habitat, especially lichen (Marmor and Randlane , 2007; Thor et al., 2010) . acid-base of the bark also affect the growth and species populations of lichens as well However, the The diversity of lichens also depends on the size of the tree habitat (Johansson et al., 2007) . In addition to lichen diversity, individual forest conditions also influenced lichen population diversity (Werakoon et al., 2010) . Lichens are related to tree characteristics and species. Habitat, including ecosystems

Wichienmatu School has a botanical garden learning center for students to study the environment. The researchrer interest and want to learn about the environment in the community. And the school is located near the Southern International Botanical Garden (Thung Khai), which is a natural learning center that is worth exploring. And has been popular with tourists who are fascinated by nature. The organizing committee saw the relationship of a variety of lichen with different bark surface characteristics the researcher survey and study information on physical factors involved as follows air temperature relative humidity of air, light intensity, acidity-base of each tree bark characteristics of the skin of each tree bark Bark surface appearance and number and type of lichen.

Objectives

1. To study the relationship of physical characteristics related to Diversity of lichen in Southern International Botanical Garden (Thung Khai), Yan Ta Khao District, Trang Province.

2. To explore the diversity of lichen on the bark surface of each species. in the Southern Botanical Garden (Thung Khai), Yan Ta Khao District, Trang Province.

Questions

1. Did physical factors the diversity of lichen in the Southern Universal Botanical Garden (Thung Khai)?

2. Did the bark surface characteristics of each species are related to the diversity of lichen in the Southern International Botanical Garden (Thung Khai), Yan Ta Khao District, Trang Province?

Hypothesis

1. If the physical factors are different Therefore , the diversity of lichen in the Southern International Botanical Garden (Thung Khai)

2. Different bark characteristics distinguish the lichen variety in the Southern Universal Botanical Garden (Thung Khai).

Materials and equipment

1. telephone
2. knife
3. 2CU Smart Lens
4. zip lock bag
5. digital hygrometer
6. beaker
7. microscope
8. corrode
9. stereo camera
10. distilled water
11. pH Meter
12. distilled water bottle
13. (Moisture & pH Meter)
14. two position scales
15. tape measure
16. notebook
17. stationery
18. tape measure

GLOBE protocal

Biosphere

Atmosphere

Study point determination

The samples were collected randomly at Southern International Botanical Garden (Thung Khai), Thung Khai Subdistrict , Yan Ta Khao District, Trang Province.

Method

1. Research preparation stage

1) Set up a study topic, choose a topic that you want to study.

2) Study and collect knowledge and theories related to research

3) determine the purpose of the study

4) Determine the sampling point. in the study area

2. Procedure

1) Make a research action plan

2) Conduct a survey of the area to be researched

3) Measure physical factors According to the principles of GLOBE as follows:

1) Determine the sampling point by using the nature study route in the Southern International Botanical Garden (Thung Khai), Yan Ta Khao District, Trang Province.

2) Measure temperature and relative humidity by using a digital hygrometer, collecting data 3 times

3) Measure the light intensity by using a moisture meter and soil pH (Moisture & pH Meter)

4) Send data to GLOBE Data Entry

Sampling of lichen

1. Survey and collect lichen specimens in the Southern Botanical Garden (Thung Khai), Thung Khai Subdistrict, Yan Ta Khao District, Trang Province during February, until March 25 65 _ by collecting samples on the tree by choosing an area that is a tourist point at the tourists popular to use the area Both in the open area with good light and the area where the light shines quite a bit. Record the habitats found. Growth patterns of each

lichen were recorded and each lichen was recorded using CU Smart lens , classified according to the bark characteristics of the lichens growing.

2. The morphology of the lichens collected in the field was studied in detail and studied under stereo and microscope and to identify the types of lichen Record the characteristics of each sample of lichen. Then compare those characteristics with classification guides to find the name of the specific lichen, such as the color and appearance of the thallus. size of thallus.

3. The data obtained were compared with The Wind Detective's Guide Test Edition Green World Foundation.

Analysis and conclusion of research

1) Take the data to analyze and compare the relationship by the statistics used to analyze the data including geographical coordinates air temperature air relative humidity Acid-base of each tree bark, light intensity, and surface characteristics of each tree bark.

The bark surface characteristics and the number and type of lichen.

2) Make a graph showing the average of the comparative data.

3) Summarize the results of the experiment.

Results

Results Geographic coordinates Conducted a study on the nature trail in the Southern Botanical Garden (Thung Khai), Thung Khai Subdistrict, Yan Ta Khao District, Trang Province as shown in Table 1.

Table 1 Shows geographic coordinates.

Study area	geographic coordinates	
	Latitude (N)	Longitude (E)
beginning	7.464684	99.640279
the end	7.468181	99.639952

The temperature of the air in the area of the tree studied found that the temperature in the red hill tree The highest mean temperature was 33.3 ± 1.910 degrees Celsius, followed by the Taew tree area. with an average temperature of 32.6 ± 2.157 and the lowest mean temperature of 27.8 ± 1.210 in the area of Phayom, as shown in Table 2.

Table 2 Shows Air temperature display area of trees studied

Species of tree	Air temperature (° C)			average
	1st	2nd	3rd	
Shorea roxburghii G. Don	28.9	28	26.5	27.8±1.210
Microcos tomentosa Sm.	28.9	28.4	26.1	27.8±1.490
Garcinia merguensis Wight	29.3	29	26.9	28.4±1.310
Cotylelobium lanceolatum Craib	29.9	29.7	28.4	29.3±0.813
Knema globularia (Lam.) Warb.	30.7	30	29	29.9±0.850
Barringtonia macrocarpa Hassk	29.2	28.9	26.6	28.2±1.423
Carallia brachiata (Lour.) Merr.	31.9	31.4	30.4	31.2±0.763
Crypteronia paniculata Blume	29.4	29.4	28.2	29.0±0.690
Licuala grandis H. Wendl.	29.2	29.1	28.7	29.0±0.260
Cratoxylum maingayi Dyer	34.1	33.7	30.2	32.6±2.157
Syzygium subsp. *Circumscissum* (Gagnep.) Chantar.& J.Parn)	34.5	34.3	31.1	33.3±1.910
Dillenia obovate (Blume) Hoogland	30.4	30.1	29.4	29.9±0.517

Relative humidity of the air found that the persimmon tree had the highest relative humidity, with an average of 72.33 ± 1.15 . followed by the Phayom tree with a mean of 71.67 ± 1.25 and the tree with the lowest relative humidity, Daeng Khao, with a mean of 42.33 ± 0.58, as shown in Table 3 .

Table 3 Shows The relative humidity of the air.

Species of tree	Air relative humidity (%)			average
	1st	2nd	3rd	
Shorea roxburghii G. Don	72	73	70	71.67±1.25
Microcos tomentosa Sm.	71	73	73	72.33±1.15
Garcinia merguensis Wight	69	70	72	70.33 ±1.53
Cotylelobium lanceolatum Craib	70	71	71	70.67 ±0.58
Knema globularia (Lam.) Warb.	62	62	61	61.67 ±0.58
Barringtonia macrocarpa Hassk	70	71	70	70.33 ±0.58
Carallia brachiata (Lour.) Merr.	57	56	58	57.00 ±1.00
Crypteronia paniculata Blume	56	56	57	56.33 ±0.58
Licuala grandis H. Wendl.	67	65	66	66.00 ±1.00
Cratoxylum maingayi Dyer	49	50	50	49.67 ±0.58
Syzygium subsp. *Circumscissum* (Gagnep.) Chantar.& J.Parn)	42	42	43	42.33 ±0.58
Dillenia obovate (Blume) Hoogland	61	62	62	61.67±0.58

Light intensity measurements revealed that the highest light intensity was at the palm spur area with an average of 18333.33 lux , followed by the rostrum area with an average of 1,300 lux , and the lowest mean was the rhinoceros blood tree area. 283.33 as in Table 4.

Table 4 Shows the intensity of light.

Species of tree	Light intensity (Lux)			average
	1st	2nd	3rd	
Shorea roxburghii G. Don	300	300	200	266.67
Microcos tomentosa Sm.	1500	1300	1100	1300.00
Garcinia merguensis Wight	200	200	150	183.33
Cotylelobium lanceolatum Craib	300	400	250	316.67
Knema globularia (Lam.) Warb.	300	300	250	283.33
Barringtonia macrocarpa Hassk	350	350	2050	916.67
Carallia brachiata (Lour.) Merr.	350	300	250	300.00
Crypteronia paniculata Blume	300	350	300	316.67
Licuala grandis H. Wendl.	2000	2000	1500	1833.33
Cratoxylum maingayi Dyer	500	400	300	400.00
Syzygium subsp. *Circumscissum* (Gagnep.) Chantar.& J.Parn)	500	400	350	416.67
Dillenia obovate (Blume) Hoogland	600	500	450	516.67

Measurement of pH Of the bark, it was found that the highest pH was 6.20 ± 0.10 mean bark acidity of blood rhinoceros, followed by 6.07 ± 0.06 bark mean, and the lowest mean was the bark mean. Acid-base, Ton Daeng Khao 4.50 ± 0.10 as shown in Table 5 .

Table 5 Shows the pH of the bark .

Species of tree	The pH of the bark			average
	1st	2nd	3rd	
Shorea roxburghii G. Don	4.7	4.6	4.5	4.6±0.08
Microcos tomentosa Sm.	4.8	4.6	4.5	4.63±0.15
Garcinia merguensis Wight	4.6	4.6	4.7	4.63±0.06
Cotylelobium lanceolatum Craib	5.3	5.1	5.4	5.27±0.15
Knema globularia (Lam.) Warb.	6.1	6.3	6.2	6.20±0.10
Barringtonia macrocarpa Hassk	5.3	5.1	5.2	5.20±0.10
Carallia brachiata (Lour.) Merr.	5.7	5.6	5.4	5.57±0.15
Crypteronia paniculata Blume	6	6.1	6.1	6.07±0.06
Licuala grandis H. Wendl.	5	5.1	5.3	5.13±0.15
Cratoxylum maingayi Dyer	4.8	4.7	4.5	4.67±0.15
Syzygium subsp. *Circumscissum* (Gagnep.) Chantar.& J.Parn)	4.5	4.6	4.4	4.50±0.10
Dillenia obovate (Blume) Hoogland	5	5.1	5.3	5.13±0.15

The study of bark surface characteristics revealed that 12 species of lichens were found in the bark surface of 3 species. Types are the most 6 types of bark surfaces, followed by 4 types of smooth bark, and the least are 2 types of furrowed bark surfaces as shown in Table 6.

Table 6 Shows the appearance of the bark

The appearance of the bark	Species of tree
The bark surface is broken into sheets or scales.	*Knema globularia* (Lam.) Warb.
	Dillenia obovate (Blume) Hoogland
	Crypteronia paniculata Blume
	Microcos tomentosa Sm .
	Garcinia merguensis Wight
	Syzygium subsp.
smooth bark surface	*Barringtonia macrocarpa*
	Carallia's throat dryness *brachiata* (Lour .) Merr.
	Licuala grandis H. Wendl.
	Cratoxylum maingai dyer
The skin of the bark is cracked into grooves.	*Shorea roxburghii* G. Don
	Cotylelobium lanceolatum Craib

The relationship of the nature of the bark surface. kind of tree and physical factors. It was found that the bark surface was broken into sheets or scales. The temperature is between 27-33 degrees Celsius. Relative humidity is between 42-72 % , the bark surface pH is between 4.5-6.20 and the light intensity is between 183.33 - 516.67 lux . Appearance The bark is smooth, the temperature is between 27.8 -32.6 degrees Celsius. Relative humidity is between 49.67 -67 % , the pH of the bark surface is between 4.63- 6.07 . and light intensity between 316.67 - 1833.33 lux The surface of the bark is cracked, the temperature is between 27.8 -28.2 degrees Celsius . Relative humidity is between 70.33 72.33% , pH of the bark surface is between 4.63-5.20 . and light intensity between 916.67 -1300 lux Shown as shown in Table 7 .

Table 7 Shows the relationship of the bark surface. kind of tree and physical factors

the appearance of the bark	Species of tree	temperature	relative humidity	pH - bark	light intensity
The bark surface is broken into sheets or scales.	*Knema globularia*	29.9 ±0.85	61.67 ±0.58	6.20±0.10	283.33
	Dillenia obovate	29.9 ±0.51	61.67 ±0.58	5.13±0.15	516.67
	Crypteronia paniculata	27.8 ±1.21	71.67±1.25	4.6±0.08	266.67
	Microcos tomentosa	28.4 ±1.31	70.33 ±1.53	4.63±0.06	183.33
	Garcinia merguensis	29.3 ±0.81	70.67 ±0.58	5.27±0.15	316.67
	Syzygium subsp.	33.3 ±1.91	42.33 ±0.58	4.50±0.10	416.67
smooth bark	*Barringtonia macrocarpa*	31.2 ±0.76	57.00 ±1.00	5.57±0.15	300
	Carallia brachiata	29.0 ±0.69	56.33 ±0.58	6.07±0.06	316.67
	Licuala grandis	29.0 ±0.26	66.00 ±1.00	5.13±0.15	1833.33
	Cratoxylum maingai	32.6 ±2.15	49.67 ±0.58	4.67±0.15	400
The skin of the bark is cracked into grooves.	*Shorea roxburghii*	27.8 ±1.49	72.33 ±1.15	4.63±0.15	1300
	Cotylelobium lanceolatum	28.2 ±1.42	70.33 ±0.58	5.20±0.10	916.67

The correlation of bark surface characteristics and diversity of lichen found on the host plant of 12 species of lichen revealed that bark surface characteristics Smooth, with the greatest variety of lichen , 12 species, followed by 8 types of scaly bark or scaly bark, and the least is 5 furrowed bark surface , as shown in Table 8

Table 8 Relationships between bark surface and 2lichen diversity

bark texture	quantity	Species of lichen	
The bark surface is broken into sheets or scales.	8	*Cryptothecia* sp.	*Dirinaria* sp.
		Pyxine cocoes	*Trypethelium tropicum*
		Amandinea extunate	*Trypethelium eluteriae*
		Lecanora sp.	*Glyphis & Sacographa*
smooth bark	12	*Amandinea extunate*	*Anthracothecium* sp .
		Arthonia sp .	*Cryptothecia* sp .
		Chrysothrix sp .	*Dirinaria* sp .
		Graphid sp .	*Glyphis & Sacographa*
		Lecanaro sp .	*Laurera benguelensis*
		Pyxine cocoes	*Trypethelium tropics ,*
The skin of the bark is cracked into grooves.	5	*Cryptothecia* sp .	*Dirinaria* sp .
		Lecanaro sp .	*Parmotrema tinctorum*
		Pyxine cocoes	

Conclusion and discussion

Part 1

The relationship of physical characteristics related to Diversity of lichen , Southern International Botanical Garden (Thung Khai), Yan Ta Khao District, Trang Province It was found that the temperature of the trees and the relative humidity were related. The trees in the high temperature area have low relative humidity. part of the tree in the area There is a low temperature with high relative humidity. where temperature and relative humidity affect the growth of lichen The higher the relative humidity and the low temperature, the lichens grow better than the low relative humidity but high temperature. Lichens live on the bark surface where the pH is more acidic than base. and in areas with high light intensity than those with low light intensity.

part 2

The diversity of lichens on the bark surface of each species In the Southern International Botanical Garden (Thung Khai), Yan Ta Khao District, Trang Province, it was found that the bark surface Affects the diversity of lichen . In the study area, 3 groups of bark surface characteristics can be identified: scaly bark surface , 8 types of lichen , and 12 types of smooth bark. and the bark surface fissures were found of 5 types of lichens , some of which were found on the bark surfaces of all three groups. Total lichens found in the Southern Botanical Garden Universal Nature Trail (Thung Khai) included. 14 species, including *Cryptothecia* sp., *Dirinaria* sp., *Pyxine cocoes , Trypethelium tropics , Amandinea extunate , Trypethelium eluteriae , Lecanora* sp., Glyphis & Sacographa , *Arthonia* sp *., Chrysothrix* sp *., Graphid* sp *., Anthracothecium* sp *., Laurera benguelensis , Parmotrema tinctorum*

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References

Sueb Nakhasathien Foundation . **Leiken .** [online]. Retrieved from https://www.seub.or.th/bloging/knowledge/

Department of Biology Faculty of Science Ramkhamhaeng University . **Lichen Research Unit .** [online] Retrieved from http://www.lichen.ru.ac.th/index.php/lichen/identify

AUSTRALIAN NATIONAL BOTANIC GARDENS. **Alphabetical list of named lichen images.** [online]. Retrieved from https://www.anbg.gov.au/lichen/photo-list.html

Pictures of tropical lichens . [online]. Retrieved from https://www.tropicallichens.net/default.aspx?s=b

Kan Silprasit and **colleagues _ _ _ Khun Dan Prakan Chon Dam Nakhon Nayok Province .**

Soranrat Kanchanavanich . **2010** . **Detective Sailom, Survey Guide** , **Lai Ken Krongkuthep, City Air Quality Inspector** , **Green World Foundation , Bangkok.**

Chantana Rungpitakchai et al **.** (2014) **. A research report on the diversity of lichen in Yala Rajabhat University: Bio-Indices on Air Pollution .** Yala Rajabhat University

OPTIONAL BADGES

I AM A COLLABORATOR

We work as a team.The team work together to do their best. There is also a staff at Thung Khai Botanical Garden to take care of information and sample collection sites.

I MAKE AN IMPACT

The results of research studies show that physical factors and bark characteristics affect lichen diversity, allowing us to choose plants that increase lichen. Affects the ecology, atmosphere and environment of the world. Lichens can also be a tool to monitor air quality because lichens are very sensitive to air pollution, each type of lichen is specific to each type of air and is also resistant to pollution differently. Therefore, lichens can be used to indicate the climate of that area.

I AM A DATA SCIENTIST

We have collected sufficient data and use scientific process skills to interpret meanings like data tables, averaging and organizing data into graphs.