

Research Title: Impact of Air Quality Factors on Lichen Species Diversity in the Sago Palm Forest of Ban Sai Khan, Khok Saba Sub-district, Na Yong District, Trang Province

Researchers:

1. Miss Narathip Songpin
2. Miss Pennapha Meesee
3. Master Jirapat Sanee *Grade 8 Students (Secondary School)*

Advisors:

1. Mr. Veerawit Anantanasin
2. Mrs. Kanrawee Churat

School: Sawatrattanaphimuk School, Na Yong District, Trang Province

Abstract

The objective of this study was to investigate the influence of air quality on the species diversity of lichens in the Sago forest at Ban Sai Khan, Khok Saba Subdistrict, Na Yong District, Trang Province. Lichen samples were collected from perennial trees, including coconut (*Cocos nucifera*), sentang (*Azadirachta excelsa*), palm, rubber (*Hevea brasiliensis*), and sago (*Metroxylon sagu*) trees, within a height range of ground level to 2 meters. Trees selected for sampling possessed a circumference of no less than 50 centimeters, measured at a height of 130 centimeters above the ground. Subsequently, the size of the lichens was measured using a ruler, and photographic records were taken.

The results indicated that in December 2025, the average maximum temperature was 36.7°C, the average minimum temperature was 23.6°C, and the average relative humidity was 80%. In January 2026, the average maximum temperature was 40.4°C, the average minimum temperature was 23.4°C, and the average relative humidity was 81%.

Regarding lichen diversity in the Sago forest, the survey revealed the following: On coconut trees, Crustose lichens (*Tephromela* sp.) and Squamulose lichens (*Phyllopsora furfuracea*) were

found. On sago and sentang trees, Crustose lichens (*Sarcographa labyrinthica*) were identified. On rubber trees, Crustose lichens (*Tephromela* sp., *Graphis* sp., and *Diorygma* sp.) and Squamulose lichens (*Phyllopsora furfuracea*) were observed. On palm trees, Squamulose lichens (*Phyllopsora furfuracea*) were present. These findings suggest that the Sago forest at Ban Sai Khan maintains clean air quality and exhibits high ecological fertility throughout the year.

Keywords: Lichen, Sago forest, Squamulose, Crustose

Introduction

The Sago Palm Forest ecosystem, located in Ban Sai Khan, Khok Saba Subdistrict, Na Yong District, Trang Province, represents an area of unique ecological characteristics and holds significant importance for local biodiversity. However, fluctuations in environmental conditions and atmospheric properties—specifically temperature and relative humidity, which are fundamental factors influencing the survival of organisms at the micro-level—have emerged as critical issues affecting the ecological balance of this area.

Lichens are composite organisms resulting from a symbiotic relationship between fungi and algae. They possess distinct characteristics as bioindicators due to their lack of a filtration mechanism for substances absorbed from the atmosphere. Consequently, they are significantly sensitive to variations in meteorological conditions and air pollution. Preliminary studies indicate that the distribution of lichen species varies according to climatic characteristics and forest conditions. For instance, Crustose and Squamulose lichens are typically found in forest environments characterized by high humidity and specific temperature ranges.

Consequently, the research team, comprising Grade 8 (Mathayom 2) students from Sawat Rattanaphimuk School, recognizes the importance of investigating the correlation between atmospheric physical factors and the diversity of lichen species within the Sago Palm Forest. This study aims to analyze how local atmospheric properties influence the occurrence and distribution of lichen species. The findings will not only contribute to the taxonomic knowledge of local lichens but also serve as an empirical database for environmental quality assessment. Furthermore, this research intends to provide guidelines for the sustainable conservation of natural resources in Na Yong District, Trang Province.

2. Research Methodology

2.1 Study Site Selection The study was conducted at the Sago Palm Forest in Ban Sai Khan, Khok Saba Sub-district, Na Yong District, Trang Province. The study site is located at coordinates 7.491238° N, 99.712458° E.

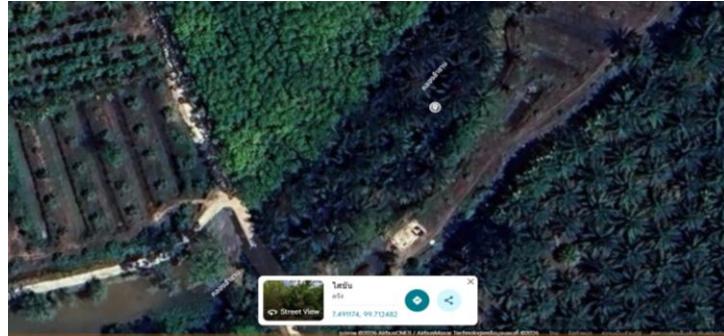


Figure 1: Study site at Ban Sai Khan Sago Palm Forest, Khok Saba, Na Yong, Trang
(Source: Google Maps).

2.2 Sampling and Preparation

Lichen samples were collected from various host trees, including Coconut (*Cocos nucifera*), *Azadirachta excelsa*, Oil Palm, Para Rubber, and Sago Palm within the study area. Data was collected from the ground level up to a height of 2 meters. The trees selected for sampling had a diameter at breast height (DBH) measured at 130 cm from the ground of no less than 50 cm in circumference. Lichen sizes were measured using a ruler and documented through photography. For sample collection, water was sprayed onto the lichens for 1–2 minutes to soften the thallus, allowing the algal layer to become clearly visible. Samples were carefully detached using a knife or cutter, wrapped in tissue paper, and placed in specimen bags. Site data, including date of collection, host tree species, tree circumference, and lichen population count, were recorded. The specimens were subsequently identified according to the "Detective of the Wind 2" classification manual.

2.3 Environmental Data Collection

The following environmental factors and instruments were utilized:

- **Temperature:** Maximum and Minimum Thermometer.
- **Humidity:** Hygrometer.
- **Direction:** Compass.

Research Equipment:

1. FUJI Hygrometer
2. MAXIMA-MINIMA Thermometer
3. Magnifying glass
4. Rain gauge
5. Ziplock bags
6. Knife / Utility cutter
7. Ruler
8. Tissue paper
9. Measuring tape
10. Cloud chart
11. Spray bottle

Results of the Study

Investigation of Physical Factors and Lichen Diversity on Trees in the Sago Palm Forest, Ban Sai Khan, Khok Saba Subdistrict, Na Yong District, Trang Province.

Table 1: Average Maximum-Minimum Temperature and Average Relative Humidity During the Data Collection Period

Data Collection Period	Measurement Time	Mean Max Temp (°C)	Mean Min Temp (°C)	Wet Bulb Temp (°C)	Dry Bulb Temp (°C)	Mean Relative Humidity (%)
December	Approx. 12:00 PM	36.7	23.6	27.0	29.4	80%
January	Approx. 12:00 PM	40.4	23.4	27.0	29.0	81%

Table 2: Sky Conditions on Field Study Dates

Study Date	Cloud Characteristics	Cloud Cover Amount	Interpretation
December 5, 2025	Low-level clouds; Stratocumulus/Cumulonimbus formations.	90.0%	Overcast; Cloud cover exceeding a ratio of 9/10.
January 13, 2026	Aggregated and scattered clouds; appearing as both lumps and sheets (Altocumulus and Cirrus).	27.5%	Scattered clouds.

Table 3: Record of Lichens Found in the Sago Palm Forest, Ban Sai Khan, Khok Saba Subdistrict, Na Yong District, Trang Province

Host Tree Species	Lichen Type	Species / Genus	Attachment Characteristics	Color	Size (cm)	Environment
Coconut Palm (<i>Cocos nucifera L.</i>)	Squamulose	<i>Phyllopsora furfuracea</i>	Tightly attached to the bark.	Light Green	1.5	Shaded / Slightly Humid
Coconut Palm (<i>Cocos nucifera L.</i>)	Crustose	<i>Tephromela</i> sp.	Attached to bark via fungal hyphae from the medulla layer.	Greenish-White	5.0	Shaded / Slightly Humid
Sentang / Thiam (<i>Azadirachta excelsa</i>)	Crustose	<i>Sarcographa labyrinthica</i>	Attached to the bark surface.	Greyish-White	13.0	Shaded / Slightly Humid
Sago Palm (<i>Metroxylon sagu Rottb.</i>)	Crustose	<i>Sarcographa labyrinthica</i>	Tightly adhered to the bark surface.	Greenish-White	2.0	Shaded / Slightly Humid
Palm (<i>Arecaceae</i>)	Crustose	<i>Sarcographa labyrinthica</i>	Completely adhered to the wood surface.	Greenish-White	8.0	Shaded / Slightly Humid
Palm (<i>Arecaceae</i>)	Squamulose	<i>Phyllopsora furfuracea</i>	Tightly attached to the bark.	Light Green	1.5	Shaded / Slightly Humid

Rubber Tree (<i>Hevea brasiliensis</i>)	Crustose	<i>Tephromela</i> sp.	Attached firmly via hyphae extending into the substrate; adhered flatly to the surface.	Dark Black with Grey Rim	17.0	Shaded / Slightly Humid
Rubber Tree (<i>Hevea brasiliensis</i>)	Crustose	<i>Graphis</i> sp.	Attached to the wood surface.	Black	10.0	Shaded / Slightly Humid
Rubber Tree (<i>Hevea brasiliensis</i>)	Crustose	<i>Diorygma</i> sp.	Tightly attached to the bark.	White with Grey Rim	13.0	Shaded / Slightly Humid
Rubber Tree (<i>Hevea brasiliensis</i>)	Squamulose	<i>Phyllopsora</i> <i>furfuracea</i>	Attached to the bark surface; characterized by small scale-like leaves.	Light Green	1.8	Shaded / Slightly Humid

Table 4: Summary of Lichen Species Found in the Sago Palm Forest

Host Tree Species	Crustose				Squamulose	Foliose	Fruticose
	<i>Tephromela</i>	<i>Graphis</i>	<i>Sarcographa labyrinthica</i>	<i>Diorygma</i>	<i>Phyllopsora furfuracea</i>		
Coconut Palm (<i>Cocos nucifera L.</i>)	✓	-	-	-	✓	-	-
Sentang / Thiam (<i>Azadirachta excelsa</i>)	-	-	✓	-	-	-	-
Sago Palm (<i>Metroxylon sagu Rottb.</i>)	-	-	✓	-	-	-	-
Palm (<i>Arecaceae</i>)	-	-	✓	-	✓	-	-
Rubber Tree (<i>Hevea brasiliensis</i>)	✓	✓	-	✓	✓	-	-

Lichen Species Descriptions

1. *Tephromela* sp.



- **Characteristics:** Grey thallus with a rough surface. Dark black apothecia with grey margins.
- **Spores:** Hyaline (clear), ellipsoid, non-septate (simple).
- **Habitat:** Commonly found in the canopy of tropical rainforests.

2. *Graphis* sp.



- **Characteristics:** Grey thallus with a smooth surface. Apothecia are narrow and slit-like (lirellae), shiny black in color.
- **Spores:** Hyaline (clear), ellipsoid, multicellular.
- **Habitat:** Dominant in open forests or deciduous forests.

3. *Phyllopsora furfuracea*



- **Characteristics:** Green thallus composed of small, overlapping scales (squamules). Brown hypothallus.
- **Habitat:** Dominant in tropical rainforests.

4. *Sarcographa labyrinthica*



- **Characteristics:** Greenish-brown thallus with a smooth surface. Apothecia are clustered and covered with grey pruina (crystals).
- **Spores:** Brown, ellipsoid, multicellular.
- **Habitat:** Found across various forest conditions.

5. *Diorygma* sp.



- **Characteristics:** Grey thallus with a smooth surface. Apothecia are widely open, covered with white pruina, branched, and have grey margins.
- **Spores:** Hyaline (clear), ellipsoid, muriform.
- **Habitat:** Dominant in open forests.

Conclusion

The study investigated the physical environmental factors in the Sago Palm Forest of Ban Sai Khan, Khok Saba Sub-district, Na Yong District, Trang Province. In December 2025, the average maximum temperature was recorded at 36.7°C, the average minimum temperature at 23.6°C, and the average relative humidity at 80%. In January 2026, the average maximum temperature increased to 40.4°C, the average minimum temperature was 23.4°C, and the average relative humidity was 81%.

The survey of lichen species diversity within the Sago Palm Forest identified several prominent genera and species with the following characteristics:

- *Tephromela* sp.: Distinguished by a grey, rugose (rough) thallus and dark black apothecia with grey margins. The spores are hyaline (clear), elliptical, and non-septate. This genus is typically found on the canopy of tropical rainforests.
- *Graphis* sp.: Characterized by a smooth grey thallus and narrow, elongated, glossy black apothecia. The spores are hyaline, elliptical, and multi-cellular. This genus is predominantly found in open forests.
- *Phyllopsora furfuracea*: Identified by a green thallus consisting of small, overlapping squamules and a brown hypothallus. This species is commonly found in tropical rainforests.
- *Sarcographa labyrinthica*: Characterized by a brownish-green, smooth thallus. The apothecia are clustered and covered with grey crystals. The spores are brown, elliptical, and multi-cellular. This species is distributed across various forest types.
- *Diorygma* sp.: Characterized by a smooth grey thallus and wide, branched apothecia covered with white crystals and grey margins. The spores are hyaline and muriform-elliptical. This genus is prominently found in open forests.

References

- Aptroot, A., & Lücking, R. (2021). A community-based identification guide to tropical lichens. *Field Studies in Lichenology*.
- Boonpeng, C., Polyiam, W., Sriprayoon, M., Prompinij, P., Sangiamdee, R., & Wolterbeek, B. Th. (2020). Assessing air quality in urban areas using lichen communities as bioindicators. *Journal of Environmental Management*, 255, 109863.
- Phraputthajamnong, P., et al. (2022). Lichen diversity and its relationship with environmental factors in green areas. *Journal of Science and Technology*. [In Thai]
- Wichian, K., et al. (2021). The use of lichens as bioindicators for monitoring air quality in the southern region. *Environmental Research Journal*. [In Thai]
- Wolterbeek, B. Th. (2021). Lichens as biomonitor of air quality: 50 years of development. *International Journal of Environmental Research and Public Health*, 18(1), 322.

GLOBE DATA ENTRY

Clouds	
Measured Date:	2025-12-05
Organization Name:	Sawat Rattanapimuk
Site ID:	408799
Site Name:	Sagu Forest Bann Saikan
Country Name:	Thailand
Country Code:	THA
Latitude:	7.49389
Longitude:	99.71295
Elevation:	27m
Measured At:	2025-12-05T05:15:00
Solar Measured At:	2025-12-05T12:03:00
Cloud Cover:	isolated
Cirrocumulus:	true
Cumulus:	true
Cloud Cover Mid:	isolated
Short Lived Contrails:	1
Spreading Contrails:	0
Non-Spreading Contrails:	0
Sky Visibility:	unusually clear
Sky Color:	light blue
Standing Water:	true
Muddy:	true
Leaves on Trees:	true
Data Source:	GLOBE Observer App
Satellite Match:	Match Not Available
Show on Map	

Measured Date: 2026-01-13
Organization Name: Sawat Rattanapimuk
Site ID: 408078
Site Name: 47NN0786281
Country Name: Thailand
Country Code: THA
Latitude: 7.491077
Longitude: 99.712381
Elevation: 24.6m
Measured At: 2026-01-13T08:33:00
Solar Measured At: 2026-01-13T15:02:00
Cloud Cover: scattered
Cloud Cover Mid: isolated
Cloud Cover Low: isolated
Opacity Mid: transparent
Opacity Low: transparent
Sky Visibility: clear
Sky Color: blue
Dry Ground: true