



Exploration of Lichen Species in the Minanga Waterfall Area, Rantau Balai Village, Aranio Subdistrict, South Kalimantan

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Abstract

Lichens are symbiotic organisms formed by the union of fungi and algae or cyanobacteria that play an important role in ecosystems, including as bioindicators of environmental quality, pioneers in soil formation, and producers of bioactive compounds. The Minanga Waterfall area, located in Rantau Balai Village, Aranio Subdistrict, Banjar Regency, has a humid, shaded environment with relatively low pollution levels, making it a potential habitat for various lichen species. This study aims to identify the lichen species found in the Minanga Waterfall area. The research was conducted using an exploratory survey method with purposive sampling and transect surveys along predetermined observation routes. Data were obtained through direct observation, documentation, morphological identification, and literature review to determine the species found. The results showed that 14 lichen species belonging to 14 families were identified, namely *Phlyctis argena*, *Punctelia jeckeri*, *Dyplolabia afzelii*, *Rhizocarpon lecanorinum*, *Phellinidium ferrugineofuscum*, *Cylindrobasidium laeve*, *Leptogium cyanescens*, *Trapelia coarctata*, *Trypethelium virens*, *Bacidia viridifarinsa*, *Ceriporia purpurea*, *Peniophora limitata*, *Lepraria finkii*, and *Dictyonema sericeum*. Most species were found on tree trunks, with crustose thalli being the dominant type. The results of this study can serve as a source of scientific information on lichens in the Minanga Waterfall area and support the utilization of local resources as a source of biology education.

Keywords: lichen, crustose lichen, species identification, Minanga Waterfall, South Kalimantan

INTRODUCTION

Lichens are organisms resulting from a symbiotic relationship between fungi (mycobionts) and algae or cyanobacteria (photobionts), forming a single living unit with distinctive morphological and physiological characteristics. These organisms can grow on various substrates, such as tree trunks, rocks, soil, and the surfaces of other objects. Lichens play an important ecological role as bioindicators of environmental quality, pioneer organisms in soil formation, and producers of various bioactive compounds that are

beneficial to the environment and the pharmaceutical industry. Environmental conditions such as humidity, temperature, light intensity, and air pollution levels are factors that influence the growth and distribution of lichens.

Research on lichens has been extensively conducted over the past decade in various regions of Indonesia. (Sonia dkk., 2024)) reported 28 lichen species found in the Gunung Menumbing Nature Reserve, Bangka Belitung Islands Province. (Widodo dkk., 2023) identified six lichen species in the Kandung Nature Tourism Area, Tulungagung Regency. (Kamaluddin dkk., 2022) reported 21 lichen species in the foothills of Mount Mutis, East Nusa Tenggara. These research findings indicate that the presence and composition of lichen species vary across different regions depending on habitat characteristics and environmental conditions.

The Minanga Waterfall area, located in Rantau Balai Village, Aranio Subdistrict, Banjar Regency, is an area that still retains its natural environment, characterized by high humidity, good vegetation cover, and minimal anthropogenic disturbance. These characteristics indicate that the Minanga Waterfall area has the potential to serve as a habitat that supports the growth of various lichen species. Information regarding the types of lichens found in this area remains very limited and has not yet been scientifically documented.

Previous research has generally been conducted in protected forests, botanical gardens, arboretums, nature tourism areas, and mangrove ecosystems. To date, no data on lichen species in the Minanga Waterfall area is available. This situation indicates a research gap namely, the lack of scientific information on the lichen species growing in the Minanga Waterfall area, even though this area possesses environmental characteristics that have the potential to support the presence of various lichen species.

The novelty of this study lies in the presentation of data identifying lichen species found in the Minanga Waterfall area, Rantau Balai Village, Aranio Subdistrict, Banjar Regency, which have not been previously reported. This study is expected to contribute to the scientific knowledge of lichens in South Kalimantan and serve as a foundation for further research. The objective of this study is to identify the lichen species found in the Minanga Waterfall area, Rantau Balai Village, Aranio Subdistrict, Banjar Regency.

RESEARCH METHODS

This study is a descriptive study using an exploratory survey method, aimed at identifying the types of lichens in the Minanga Waterfall area, Rantau Balai Village, Aranio Subdistrict, Banjar Regency, South Kalimantan. The study was conducted in 2026 along the trail leading to the Minanga Waterfall area.

Sampling was conducted using a purposive sampling technique combined with an exploratory survey method. Observations were made along seven transects, each 100 m long and spaced 50 m apart. The selected samples were lichens with distinct morphological characteristics that could be observed directly in the field.

Data were collected through observation and documentation. Each lichen specimen found was documented, and its characteristics including thallus shape, color, growth substrate, and habitat conditions were recorded. Species identification was based on

morphological characteristics, with the aid of various relevant literature sources and scientific references.

The data collected were analyzed using qualitative descriptive methods. The results of the identification are presented in tables and descriptive texts that include the species names, families, thallus types, morphological characteristics, and growth substrates of the lichens found in the Minanga Waterfall area.

RESULTS AND DISCUSSION

The results of a study conducted in the Minanga Waterfall area, Rantau Balai Village, Aranio Subdistrict, Banjar Regency, show that 14 lichen species were successfully identified. These species belong to two major divisions: Ascomycota and Basidiomycota. The Ascomycota division is the most dominant group with nine species, while Basidiomycota consists of five species. The lichens found are predominantly crustose thalli that generally grow on tree trunks, while several other species were found on rock substrates. The observed morphological variations include differences in thallus shape, color, surface texture, and growth patterns on the substrate. The presence of these various lichen species indicates that the Minanga Waterfall area has environmental conditions that support lichen growth, primarily due to high humidity levels, relatively dense vegetation, and a well-preserved environment. A list of lichen species found during the study is presented in Table 1.

Based on Table 1, the species found included *Phlyctis argena*, *Punctelia jeckeri*, *Dyplolabia afzelii*, *Rhizocarpon lecanorinum*, *Phellinidium ferrugineofuscum*, *Cylindrobasidium laeve*, *Leptogium cyanescens*, *Trapelia coarctata*, *Trypethelium virens*, *Bacidia viridifarinsa*, *Ceriporia purpurea*, *Peniophora limitata*, *Lepraria finkii*, and *Dictyonema sericeum*. Most species were found on tree trunks, while *Trapelia coarctata* was found on rocks. The dominance of crustose lichens indicates a high level of adaptability to substrate and environmental conditions in the study area. The dominance of Ascomycota in this study is consistent with (Nash, 2008) assertion that most of the lichens identified worldwide are members of Ascomycota because this group is highly adaptable to various environmental conditions.

According to Table 2, the Minanga Waterfall area has an air temperature of 23.2–31°C, relative humidity of 72–91%, light intensity of 1,655–8,562 lux, soil pH of 6.9, and wind speed of 0.0–1.5 m/s. These conditions indicate that the study area has an environment conducive to lichen growth. High humidity and relatively stable temperatures are believed to be the main factors supporting the presence of lichens in the study area. In addition, sufficient light intensity and pristine environmental conditions allow lichens to grow on various substrates, particularly the tree trunks that dominate the study site. This combination of environmental factors is believed to have contributed to the discovery of 14 lichen species in the Minanga Waterfall area. These conditions indicate that the study area provides a suitable habitat for the growth of both crustose and foliose lichens.

Table 1. Lichen in the Minanga Waterfall Area, Rantau Balai Village, Aranio Subdistrict

No	Species Name	Famili	Thallus Type		Morphology/Color	Substrate
			Crustose	Foliose		
1	<i>Phlyctis Argena</i> (<i>Lecidea argen</i>)	Phlyctidaceae	√		Grayish green	Tree trunk
2	<i>Punctelia jeckeri</i> (<i>Punctelia ulophylla</i>)	Parmeliaceae		√	Bluish gray	Tree trunk
3	<i>Dyplotlabia afzelii</i> (<i>Graphis afzelii</i>)	Graphidaceae	√		White	Tree trunk
4	<i>Rhizocarpon lecanorinum</i> (<i>Diplotomma geographicum</i> f.)	Rhizocarpaceae	√		Blackish green	Tree trunk
5	<i>Phellinidium ferrugineofusum</i> (<i>Polyporus marginellus</i> Peck)	Hymenochaetaceae	√		Orange	Tree trunk
6	<i>Cylindrobasidium laeve</i> (<i>Phellinus ferrugineofuscus</i>)	Physalacriaceae	√		Brown with white, hyphae-like strands	Tree trunk
7	<i>Leptogium cyanescens</i> (<i>Leptogium caesium</i>)	Collemataceae		√	Black	Tree trunk
8	<i>Trapelia coarctata</i> (<i>Biatora arridens</i>)	Trapeliaceae	√		Gray with white spots	Stone
9	<i>Trypethelium virens</i> (<i>Trypethelium exocanthum</i> Tuck.)	Trypetheliaceae	√		Yellowish green	Tree trunk
10	<i>Bacidia viridifarinoso</i> (<i>Aquacidia viridifarinoso</i>)	Ramalinaceae	√		Dark green with a slight grayish ring around the edges	Tree trunk
11	<i>Ceriporia purpurea</i> (<i>Meruliopsis purpurea</i>)	Irpicace	√		Slightly brownish cream with a pitted surface	Tree trunk
12	<i>Peniophora limitata</i> (<i>Corticium fraxineum</i>)	Peniophoraceae	√		Blackish gray	Tree trunk
13	<i>Lepraria finkii</i> (<i>Crocynia aliciae</i> Hue)	Stereocaulaceae	√		Light green with a rough surface	Tree trunk
14	<i>Dictyonema sericeum</i> (<i>Dictyonema guadalupense</i>)	Hygrophoraceae	√		Dark green	Tree trunk

Table 2. Environmental Parameters

No	Environmental Parameter	Unit	Repetitions			Range
			1	2	3	
1.	Air temperature	°C	24 -26	29,3 -31	23,2 -26,4	23,2 -31
2.	Soil moisture	%	1	1	1	1
3.	Light intensity	Lux	5210 – 7745	3531 – 8462	1655 -2008	1655 -8562
4.	Soil pH		6,9	6,9	6,9	6,9
5.	Air humidity	%	84 -86	72 -84	81 -91	72 -91
6.	Wind speed	m/s	0,0 -0,1	0,0 -1,5	0,0	0,0 -1,5

The identification results show that the lichens found in the Minanga Waterfall area exhibit diverse morphological characteristics, including variations in color, thallus shape, surface texture, and growth substrate. Most species were found growing on tree trunks, while a few were found on rocks. The presence of these various lichen species is supported by the environmental conditions of the study area, including air temperature, humidity, light intensity, soil pH, and wind speed, all of which are suitable for lichen growth. The morphological characteristics and growth habitats of each lichen species found in the study area are described as follows.

1. *Phlyctis argena*

**Figure 1.** *Phlyctis argena*

was found on tree trunks, with a grayish-green, crustose thallus. Observations showed that this species has a thallus size of approximately ± 3 cm, with an irregular, spreading growth pattern that follows the surface of the tree trunk. The thallus appears relatively smooth to slightly granular in some areas and is firmly attached to the substrate, making it difficult to separate without damaging the bark surface. The thallus margins are indistinct because its growth follows the contours of the tree trunk.

The thallus of *P. argena* typically forms patches surrounded by a white prothallus and has soralia that are paler *Phlyctis argena* than the thallus (Benfield dkk., 2009). In addition, the soralia are irregular in shape and may fuse in some parts of the thallus (Cannon dkk., 2024). These characteristics indicate that the specimen found in the Minanga Waterfall area matches the previously reported characteristics of *Phlyctis argena*.

2. *Punctelia jeckeri*



Figure 2. *Punctelia jeckeri*

Punctelia jeckeri was found on tree trunks, with a bluish-gray, foliose thallus. The thallus measures approximately ± 3 cm and resembles overlapping sheets, forming distinct lobes along its edges. As a foliose lichen, the thallus does not adhere completely to the substrate, so some parts appear slightly raised from the surface of the trunk.

These characteristics are consistent with the description by (Kukwa & Motiejūnaitė, 2012), who state that *P. jeckeri* has a thallus 3–5 cm in diameter with closely appressed lobes and rounded margins. The thallus color, ranging from greenish gray to brownish gray, and its habitat on bark are also characteristic features of this species (Martellos dkk., 2023). Furthermore, the presence of non-ciliated lobes that often exhibit soredia on the thallus surface is a distinguishing characteristic commonly found in *P. jeckeri* (Francesconi et al., 2024).

3. *Dyplolabia afzelii*



Figure 3. *Dyplolabia afzelii*

Dyplolabia afzelii was found on tree trunks, with a white, crustose thallus. The thallus measures approximately ± 2 cm, grows in a thinly spreading pattern, and adheres firmly to the trunk surface, appearing to blend in with the substrate. One of its most distinctive characteristics is the presence of elongated structures resembling lines or small scratches on the surface of the thallus, which are characteristic of this species.

These characteristics are consistent with the description by (Bungartz dkk., 2010), who stated that *D. afzelii* has a thin, crustose thallus that is almost entirely embedded in the substrate. The reproductive structures, which consist of elongated, protruding lirella-type apothecia, are also an important diagnostic characteristic of this species. The presence of a thallus firmly attached to the tree trunk and distinct lirella structures indicates that the specimen found matches the previously reported characteristics of *Dyplolabia afzelii* (Bungartz dkk., 2010).

4. *Dyplolabia afzelii*



Figure 4. *Rhizocarpon lecanorinum*

Rhizocarpon lecanorinum was found on tree trunks, with a crustose thallus that is blackish-green in color and measures approximately ± 3.5 cm. The thallus grows firmly attached to the substrate in an irregular pattern and has a cracked surface forming areoles. The clearly visible areole structure is one of the morphological characteristics that distinguishes this species from other crustose lichens.

These characteristics are consistent with the description by (Martellos dkk., 2023), who state that *R. lecanorinum* has a crustose thallus with an areolate surface and forms patches that can merge into larger colonies. The areoles are densely arranged with a smooth surface and often surround the apothecium, forming a horseshoe-like pattern. (Fryday dkk., 2024) also describe this species as having a distinctly black prothallus with areoles ranging from round to crescent-shaped at certain developmental stages.

5. *Phellinidium ferrugineofuscum*



Figure 5. *Phellinidium ferrugineofuscum*

Phellinidium ferrugineofuscum was found on tree trunks, measuring approximately ± 4 cm and ranging in color from orange to brownish-orange. This organism grows laterally across the substrate surface in an irregular pattern. Its surface appears rough, thick, and slightly undulating, with a darker color in the center of the colony compared to the edges. These characteristics indicate the presence of a fairly dense body layer that has developed on the woody substrate.

The characteristics observed are consistent with the description by (Siri dkk., 2024), which states that *P. ferrugineofuscum* has a crustose fruiting body with edges ranging in color from yellowish brown to rusty brown. The surface of this species' pores is generally purplish-brown in color, with a shape ranging from round to angular. Additionally, this species is commonly found on weathered woody substrates.

6. *Cylindrobasidium laeve*



Figure 6. *Cylindrobasidium laeve*

Cylindrobasidium laeve was found on a tree trunk substrate measuring approximately ± 1.5 cm and brown in color. This organism grows in a thin, spreading layer across the substrate's surface in an irregular pattern. The surface of the body appears relatively rough, with some areas showing a white, hyphae-like layer scattered across the surface. These characteristics provide a fairly distinct color contrast, making it easy to distinguish from other species found at the study site.

The observed characteristics are consistent with the description by (Lin dkk., 2021), who state that *C. laeve* has basidiomata attached to the substrate with a membranous texture and grows diffusely on the surface of wood. The hymenium surface is generally cream to yellowish-brown in color and may develop cracks as it ages. The margins are also reported to be paler in color and may appear finely fibrous or powdery.

7. *Leptogium cyanescens*



Figure 7. *Leptogium cyanescens*

Leptogium cyanescens was found on tree trunks, with a thallus measuring approximately ± 6 cm and black in color. The thallus is a lobed, irregularly broadened sheet with a soft, gelatin-like texture, especially when moist. As a foliose lichen, the thallus does not adhere completely to the substrate, so some parts appear to be raised off the surface of the tree trunk. This characteristic is typical of the genus *Leptogium*, which has a high water content in its thallus tissue.

The observed characteristics are consistent with (dataZone, 2017), which states that *L. cyanescens* has a sheet-like thallus with distinct lobes, a relatively smooth surface, and a dark gray to blackish color when dry. The presence of abundant isidia on the surface and edges of the thallus is also a key characteristic for identifying this species. (Marcos dkk., 2018) describe *L. cyanescens* as having a smooth upper surface with thin, rounded lobes and cylindrical isidia scattered across the thallus surface. Additionally, (Martellos dkk., 2023) note that this species has a foliose thallus that is rubbery when wet, with elongated lobes, and generally grows on bark substrates.

8. *Trapelia coarctata***Figure 8.** *Trapelia coarctata*

Trapelia coarctata was found on a rocky substrate; the thallus measured approximately ± 5 cm and was gray in color with white spots on some parts of its surface. The thallus is crustose, firmly attached to the substrate, and grows to form colonies that spread irregularly. The thallus surface appears relatively flat with a somewhat rough texture and has a fairly distinct growth boundary against the rocky substrate.

These characteristics are consistent with (Orange, 2018), who states that *T. coarctata* has a white-to-gray crustose thallus with a smooth or slightly wrinkled surface (Orange, 2018). The presence of a white prothallus and an irregular growth pattern are also common characteristics of this species. (Martellos dkk., 2023) describe *T. coarctata* as having a pale greenish-gray thallus that is either continuous or fissured, with indistinct margins. This species is generally found on rock substrates; therefore, the observed characteristics are consistent with the previously reported traits of *Trapelia coarctata*.

9. *Trypethelium virens***Figure 9.** *Trypethelium virens*

Trypethelium virens was found on tree trunks, with a thallus measuring approximately ± 4 cm and yellowish-green in color. The thallus grows in an irregular, spreading pattern across the surface of the substrate, with a relatively smooth texture and fairly distinct margins. Its dominant yellowish-green color is one of the characteristics that distinguishes this species from other crustose lichens.

These characteristics are consistent with the description by (Aptroot & Lücking, 2016) *Trypethelium virens*, who state that *T. virens* has a crustose thallus with colors ranging from olive green to yellowish. The thallus surface is generally smooth to slightly uneven and grows attached to the bark of tree trunks. Additionally, this species possesses reproductive

structures in the form of trypetelioid ascomata arranged within pseudostromata and appearing slightly raised on the thallus surface. The observed characteristics indicate that the specimen found in the Minanga Waterfall area matches the previously reported characteristics of *Trypethelium virens*.

10. *Bacidia viridifarinos*

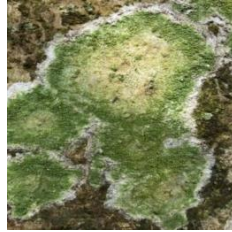


Figure 10. *Bacidia viridifarinos*

Bacidia viridifarinos is found on tree trunks, with a thallus measuring approximately ± 6 cm and dark green in color, surrounded by a thin gray margin. The thallus grows laterally, forming irregular colonies with a surface that appears somewhat powdery or granular, especially in the center of the colony. The color difference between the center and the edges of the thallus is one of the characteristics that distinguishes this species from other crustose lichens.

These characteristics are consistent with the description by (Cannon dkk., 2022), who state that *B. viridifarinos* has a crustose thallus ranging in color from green to greenish-gray and generally grows on bark or rock substrates. One of the distinctive features of this species is its bright orange fluorescence under ultraviolet light, which serves as an important diagnostic characteristic for identification. (Martellos dkk., 2023) also describe *B. viridifarinos* as having a thallus ranging in color from bluish-green to grayish-green, with a structure that can be intact or cracked, and bearing soredia. Furthermore, the presence of a whitish prothallus and soredia that can merge to form larger patches is a common characteristic of this species. The observed characteristics indicate that the specimen found in the Minanga Waterfall area matches the previously reported characteristics of *Bacidia viridifarinos*.

11. *Ceriporia purpurea*



Figure 11. *Ceriporia purpurea*

Ceriporia purpurea was found on tree trunks, with a thallus measuring approximately ± 3.5 cm and ranging in color from cream to light brown. This organism grows diffusely across the substrate surface, forming an irregularly spreading layer. The thallus surface appears porous, with fine holes evenly distributed across it, giving it a sponge-like appearance. These

characteristics serve as the primary distinguishing features of this species compared to other lichens found at the study site.

The observed characteristics are consistent with the description by (Spirin dkk., 2016), who state that *Ceriporia purpurea* has a crustose thallus that forms small, round colonies that may fuse together, reaching a width of ± 5 cm. The edges of the colonies are generally pink to reddish and may appear slightly paler than the pore surface. The pore surface of this species is generally flat with fine, evenly distributed pores and is pink to orange in color, which may darken as the organism develop. These characteristics indicate that the specimen found in the Minanga Waterfall area matches the previously reported characteristics of *Ceriporia purpurea*.

12. *Peniophora limitata*



Figure 12. *Peniophora limitata*

Peniophora limitata was found on tree trunks, with a thallus measuring approximately ± 4 cm and a blackish-gray color. This organism grows irregularly across the surface of the substrate, which has a relatively rough texture and is slightly raised in some areas. The dark color that dominates the thallus surface is one of the characteristics that distinguishes this species from other lichens found at the study site.

These characteristics are consistent with the description provided by (CROmushrooms, 2021), which states that *P. limitata* has fruiting bodies that are fully attached to the substrate and grow in the form of irregular sheets or patches. The surface of the fruiting body can appear smooth to slightly wavy, with colors ranging from purplish gray to bluish black. This species is generally found on wood substrates and grows firmly attached to its host surface. These characteristics indicate that the specimen found in the Minanga Waterfall area matches the previously reported characteristics of *Peniophora limitata*.

13. *Lepraria finkii*



Figure 13. *Lepraria finkii*

Lepraria finkii was found on tree trunks, with a thallus measuring approximately ± 4.5 cm and green in color. The thallus grows in an irregular, spreading pattern and adheres tightly to the substrate. The surface of the thallus appears rough and powdery, giving it a less compact appearance compared to other crustose lichens. These characteristics serve as distinctive features that facilitate the identification of this species in the field.

The observed characteristics are consistent with the description by (Tsurykau dkk., 2016), who state that *L. finkii* has a crustose thallus with a soft, finely hairy texture and a light green to grayish color. The thallus generally has indistinct margins and may appear partially detached from the substrate. (Martellos dkk., 2023) also describe *L. finkii* as having a coarse, powdery thallus composed of soredia-like granules and typically ranging in color from pale green to bluish-gray. These characteristics indicate that the specimen found in the Minanga Waterfall area matches the previously reported characteristics of *Lepraria finkii*.

14. *Dictyonema sericeum*



Figure 14. *Dictyonema sericeum*

Dictyonema sericeum is found on tree trunks, with a thallus measuring approximately ± 4 cm and dark green in color. The thallus grows in an irregular, spreading pattern and adheres tightly to the substrate. The thallus surface has a smooth texture resembling a woven pattern or tightly packed fine fibers, giving it a distinct appearance compared to other crustose lichens. These characteristics are distinctive features of the basidiolichen group, which belongs to the genus *Dictyonema*.

The observed characteristics are consistent with the description by (Nash, 2008) Nash et al. (2002), who state that *D. sericeum* has a green to greenish-gray thallus with a crust-like form and can grow diffusely on various substrates. The thallus surface can range from smooth to rough and often exhibits irregular growth patterns. This species is commonly found on bark, tree trunks, and rocks.

CONCLUSION

Inference must be sharp with new findings in the form of theories, postulates, formulas, rules, methods, models, prototypes, or equivalent. Conclusions must be supported by sufficient research data that answers the research objectives. That is, it is not just limited to repeating the results of the study.

This study provides new scientific data regarding the composition of lichen species in the Minanga Waterfall area, which has not previously been documented. The dominance of crustose lichens on tree trunks suggests that the environmental conditions of the area are favorable for the establishment and persistence of substrate-attached lichens. These findings

indicate that the Minanga Waterfall area functions as a suitable habitat for lichen growth and can serve as a baseline reference for future studies on lichen ecology, biodiversity conservation, and the utilization of local biological resources in South Kalimantan.

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