

# SPECIES DIVERSITY OF MOSS FLORA AT THE VICINITY OF MATIN-AW SPRING, BANGCUD, MALAYBALAY CITY, BUKIDNON

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## ABSTRACT

*Mosses are small yet significant plants that contribute to the environment in numerous ways. They prevent erosion by stabilizing soil and retaining moisture, creating habitats for various organisms, and supporting biodiversity. This study aims to explore the species richness of moss at the vicinity of Matin-aw Spring, Bangcud, Malaybalay City, Bukidnon, describe their morphological characteristics, habitat preferences and conservation status including the classification of their family, genera and species. The said study area is situated at latitude (8.051505) and longitude 124.922997 on the map of the Philippines which has an area of 500 sq. km. or approximately 1 hectare wide. The conduct of inventory and assessment of the moss species was done through an alpha taxonomy or transect walk in the site. It was done by collecting and recording the different types of moss flora found in the area. Results of the study revealed a total of thirteen (13) species of moss belonging to nine (9) families and eleven (11) genera were identified. Among the thirteen (13) species of moss, six (6) are locally assessed as abundant while the seven (7) others were classified as rare. Based on their habitat preferences, three (3) distinct habitats were identified growing on rock, tree base and tree barks. It was revealed that most of the moss species collected in the area was found on the surface of rocks while two (2) species were found on the tree barks and only one (1) species was found on the tree base. It is recommended that Matin-aw Spring must be properly conserved and enforce policies and guidelines for the protection and conservation of these important species.*

**Keyword:** *mosses, species richness, morphological characteristics, habitat preferences and conservation status*

## 1. INTRODUCTION

Species diversity plays a crucial role in understanding and conserving the natural ecosystems of the planet. Mosses, a diverse group of non-vascular plants, are known to occupy various habitats worldwide and contribute to the overall biodiversity of these ecosystems.

Springs are renowned for their high-water availability, which creates a favorable environment for the growth and proliferation of diverse plant species, including mosses. Mosses are primary producers, bioindicators, and ecosystem engineers, contributing significantly to the water cycle, creating habitats, and stabilizing soil health. They retain water, reduce drought effects, provide habitats for microfauna, and serve as a food source for various animals. They prevent soil erosion, promote biodiversity, and support

nutrient cycling. Despite their small size, mosses have a substantial impact on ecosystem balance and play a vital role in preserving the environment (Gardens, 2024). Bryophytes are a diverse group of primitive plants with about 25,000 species worldwide and the second largest group of land plants (Mishler 2001, Shaw and Renzaglia 2004). They differ from the flowering plants primarily by lacking vascular system for transporting fluids throughout the plant and reproduce by spores (Shevock et al. 2014) which include mosses. At present, only around 15,000 species have been described, although new species are continuously being explored (Sabovljević, Vujičić & Sabovljević, 2014; Azuelo, Sariana, & Pabualan, 2010). However, unsustainable practices pose threats to the already dwindling moss diversity this includes deforestation. Deforestation, conversion of forests to agricultural lands, rapidly changing

cultivations, and over collection are among the top factors affecting the bryophytes species. Consequently, many species have become extinct before they are documented (Amoroso & Aspiras, 2010). This study aims to conduct an inventory of the species richness of moss flora along Matin-aw Spring.

### **1.1.Objectives of the Study**

This study aimed to assess the species richness of moss flora at the vicinity of Matin-aw Spring, Bangcud, Malaybalay City, Bukidnon. Specifically, the following are the research objectives:

1. Conduct an inventory of the species richness of the moss in the study area;
2. Describe the collected moss species in terms of:
  - a. morphology characters
  - b. habitat preferences
  - c. conservation status
3. Classify each of the moss species according to their family, genera, and species.

### **1.2. Significance of the Study**

This research investigation holds significant importance in the field of botany and ecology, specifically to the following:

For biodiversity conservation, the findings of this study will have practical implications for conservation management and land-use planning. Understanding the moss flora in Matin-aw Spring can aid in identifying areas of high conservation value, providing a basis for the development of effective conservation strategies and policies including the protection of the Matin-aw Spring and its associated moss flora. By identifying and documenting moss species present in the area, researchers can assess the overall health of the ecosystem and make informed decisions regarding conservation efforts.

For educational and awareness purposes, the findings of this study can serve as an educational tool to raise awareness about the importance of conserving these often-overlooked species. The findings can be shared with local communities, schools, and environmental organizations to promote an understanding of the ecological value of mosses and the need for their conservation.

This can encourage public engagement and foster a sense of responsibility towards the environment.

For academics and researchers, the findings of this study can serve as a baseline for future research and conservation initiatives. The data collected on moss species diversity can be used to monitor changes in the ecosystem over time, assess the impacts of human activities or environmental disturbances on the moss community, and guide conservation efforts. By identifying and classifying moss species in the area, it provides valuable data for botanical databases and contributes to the existing knowledge of moss taxonomy.

### **1.3. Scope and Limitations of Study**

This study focused on the inventory and assessment in the species diversity of moss flora specifically at the vicinity of Matin-aw Spring situated in Bangcud, Malaybalay City, Bukidnon. It aims to explore the species richness of moss in the area, describe their morphological characteristics, habitat preferences and conservation status including the classification of their family, genera and species. It involves field surveys and collection of moss flora from different locations along Matin-aw Spring and its immediate surroundings using transect walking method. The morphological characteristics were then used to identify and describe the species of the moss collected in the area. The collected specimens will be further identified, classified, and documented using appropriate taxonomic keys, microscopy, and other relevant methods done by the expert. Local assessment and International Union for Conservation of Nature (IUCN) website was used to determine the conservation status the moss collected whether it is endemic, rare, widespread, least concern or not listed.

## **2. REVIEW OF RELATED LITERATURE**

Species diversity is unequally distributed across the globe. The exploration and documentation of the spatial patterns of species richness are of crucial importance for the conservation and sustainable use of biological resources (Mutke & Barthlott, 2005).

Bryophytes are important element of land plant diversity (Hallingba"ck & Tan, 2010) and are key species of primary succession (Goffinet & Shaw, 2008), water retention (Churchill, 2009), carbon sequestration (de Lucia et al., 2003; Hallingba"ck & Hodgetts, 2000), nutrient cycling (Chapin et al.,

1987; Turetsky, 2003), and soil erosion control (Hallingbaeck & Hodgetts, 2000). Mosses are widely distributed globally and occupy a broad range of habitats. They rarely are isolated floral individuals but instead occur in populations or colonies in characteristic growth forms, such as mats, cushions, turfs, or wefts.

The study is supported by one of the findings of local studies on the richness of Species in the Moss Flora on the Montane Vegetation of Mt. Apo Natural Park, Philippines were found, 136 mosses from 26 families and 56 genera. The families belonging to Ditrichaceae, Ephimeropsidaceae, Garovagliaceae, Lembophyllaceae, Mniaceae, Neckeraceae, and Spiridentaceae are the least species-rich, whereas Orthotrichaceae is the family with the greatest species richness (Azuelo et al., 2020).

Similarly, the research study in Mt. Matutum of South Cotabato, Philippines known to its protected landscapes, reported to have 129 species of mosses belonging to 48 genera and 23 families (Azuelo et al. 2016).

In the study conducted by Canakan et al. (2022), it is reported that Davao Oriental province in the Philippines is renowned for having a high species richness, uniqueness, and endemism. However, the vast majority have not yet been found. Their research showed that there are thirty species, seventeen genera, and thirteen families of mosses. It is said that 12 species are considered rare, compared to the 18 prolific species. Furthermore, records revealed the existence of three endemic species: *Thuidium benguetense* Broth, *Ectropothecium luzoniae* Jaeger, and *Ectropothecium ferruginum* Jaeger. Ex Bartram.

According to Alcalá (2019), 314 species and 187 genera of mosses are found in Mindanao Island; 50 of these species are unique to this island. The remaining ones can also be found in Luzon and the Visayan islands. There are 50 species of Philippine mosses known to exist on Mindanao; Of these, 4% are found across the tropics, 60% are Malesian taxa, 21% are linked to Australasia, 10% are linked to Borneo, and only 6% are linked to continental Asia. Comparing Mindanao to other major islands in the nation, it is evident that the moss flora there has a considerable southern and Australasian influence (Tan 1998).

In addition, mosses diversity in Mt. Kalatungan Range Natural Park, Bukidnon, Philippines consist

of 65 mosses belonging to 35 genera and 19 families. Taxonomic traits were utilized to classify the mosses and lichens into families, genera, and species. These characteristics included habitats, leaf arrangement and orientation, stem structure, sporophyte characteristics, and growth shape. The species is restricted to moist rocks, tree trunks, decomposing logs, twigs, and litters. In the studied sites, the percentage of lichen and moss varies from 30 to 85%. The highest species population is reflected in the montane forest's moisture level trend (Azuelo, A. & Puno, G., 2018).

Furthermore, Membreve et al. (2019) assessed the diversity and ecological status of bryophytes flora in Kalikasan Park, Albay, Philippines. A total of eight species (8) with five (5) mosses and three (3) species of liverworts were collected in all sampling areas. Microhabitats observed in the study were decayed woods, tree trunks, wet rocks and moist soils. A high index value (2.29) with evenness index of 0.996 was observed in the study area with trees having a much higher index compared to bryophytes found in fern plots. From the species, two (2) species were found to be possibly endangered with one (1) possibly near threatened of IUCN status.

Further local studies also claimed that, *Anomodontopsis rugelii* (Müll. Hal.) Ignatov & Fedosov; *Chaetomitrium horridulum* Bosch & Sande Lac.; *Chaetomitrium vrieseanum* Bosch & Sande Lac.; and *Dicranoloma deplanchei* (Duby) Par. are new country moss records while *Anomodon pseudotristis* (Müll. Hal.) Kindb.; *Bescherellia elegantissima* Duby; *Claopodium assurgens* (Sull. & Lesq.) Cardot; *Pseudoparaphysanthus moutieri* (Broth. & Paris) S. Olsson, Enroth, Huttunen & D. Quandt and *Racopilum magnirete* E.B. Bartram are new additions to the Luzon moss flora. *Anomodontopsis* Ignatov & Fedosov is a new genus record for the Philippines. The significance of ongoing bryological research in the archipelago has once again been brought to light by this report of new records for the moss flora of Luzon and the Philippines (Linis, 2021).

On the other hand, foreign studies also claimed that, Only 19.5% of the 1402 moss species that are found in North America north of Mexico are unique to the continent, according to data from the Flora of North America project (hereafter FNA; Flora of North America Editorial Committee, 2007, 2014). Because of the high frequency of common

distributions between continents, intercontinental disjunction is prioritized over endemism in bryophyte biogeography. Determining which lineages and geographical areas have high endemic populations will be necessary to comprehend the subtleties of bryophyte diversification. These places and lineages are excellent case studies for examining the variables that promote divergence and protect lineages from extinction (Carter, Shaw, & Shaw 2016).

In addition, Stebel and Fojcik (2014) noted in their study that there is 192 species of moss in Katowice, S. Poland, of which 14 are listed as endangered on the national red list, seven are listed as regionally endangered in the Silesia Province (four of which are on the former list and three more), and 48 taxa are legally protected by the Polish government (not on either of the previous lists).

The study conducted by Carter et al. (2016) expressed the FNA list of taxa for North America includes 81 families, 233 genera, and 1415 species (Flora of North America Editorial Committee, 2007, 2014). Of these, four families (4.9%), 19 genera (8.1%), and 311 minimally ranked taxa (21.7%) are endemic to the continent. For simplicity, the 303 species and eight infraspecific taxa in the data set are referred to as species throughout this paper. Three of the endemic families and 18 endemic genera are monotypic. Of the 81 families that occur in North America, 44 (54.3%) have at least one endemic species. The 11 families with the highest numbers of endemics together contain 65.4% of the endemic flora. The nine genera richest in endemics comprise 35.9% of the flora.

### **3. METHODOLOGY**

#### **3.1. Entry Protocol**

Before the researchers conducted a study, a letter of request for permission to conduct the study at Matin-aw Spring, Bangcud, Malaybalay City, Bukidnon was given to the Barangay Captain of Bangcud, Malaybalay City, Bukidnon Hon. Rosa Maria M. Robosa. After the letter was approved, the researchers now begin to undergo for their study by having an inventory and to collect different species of moss flora found in the area.

#### **3.2. Location of the Study Area**

The study area is situated at P-6 Bangcud, Malaybalay City, Bukidnon, Philippines specifically at the vicinity of Matin-aw Spring Resort. It is famous for its picturesque beauty and clear waters. It is a peaceful haven for locals and tourists, tucked away during rich green trees and rolling hills. The spring is characterized by its pure waters, which are often crystal clear and allow visitors to view the riverbed and different rocks under the surface. The riverbanks are lined with large trees, which provide shade and enhance the beauty of the region. It is situated at latitude (8.051505) and longitude 124.922997 on the map of the Philippines. Matin-aw Spring Resort has an area of 500 sq. km. or approximately 1 hectare wide and about meters away from the crossing of Bangcud. It can be traveled minutes away from Malaybalay and Valencia City.

#### **3.3. Materials Used in the Study**

The researchers used thermometer, cotton and straw rope to measure the humidity of the study area. The researchers also used mobile devices to measure the elevation including cloud watching, and light intensity of the area. During the collection of the specimens, the researchers used the following materials such as packet label, knife, pencil and mobile phone for the collection, recording and photo documentation of the specimen. During the taxonomic classification, the following materials were used: magnifying or field lens, Light microscope, glass slides and cover slips.

#### **3.4. Establishment of the Study Area**

The conduct of inventory and assessment of the species diversity of moss flora at the vicinity of Matin-aw Spring was done through an alpha taxonomy or transect walk in the site. It was done by collecting and recording the different types of moss flora found in the area. The researchers carefully ensured that the whole area of Matin-aw Spring was being surveyed based on the availability of moss specimen.

#### **3.5. Methods of Collection and Preparation**

The study site is advantageous for the perpetuation of moss flora because of its elevation, ideal temperature, as well as its favorable environmental conditions. The specimen of mosses was collected within the vicinity of Matin-aw Spring from the base up to the

end portion of the Matin-aw Spring through an alpha taxonomy or transect walking for the inventory and assessment of moss diversity. The collected specimens of mosses were placed in a packet envelope labelled with the following data: collection number, corresponding altitude, and its associated habitats. This was then air-dried before it was placed in a standard packet for herbarium vouchers.

### 3.6. Species Identification, Classification, Description and Confirmation

A field of floristic inventory was employed for the species diversity of moss at the vicinity of Matin-aw Spring, Bangcud, Malaybalay City, Bukidnon. The different species of moss that were collected was identified and described individually based on their morphological characteristics such as leaf color, leaf shape, leaf size, leaf margins, leaf apex, leaf base and leaf arrangement. The specimens of moss that were collected was pre-identified by the researchers and was confirmed by Dr. Andrea G. Azuelo, a bryologist who is expert in the field.

### 3.7. Photo Documentation

The researchers used mobile phone to take photographs of the different species of mosses that was collected including the area of study and their actual habitat. In addition, the researchers used google lens as an aide in pre-identifying the collected samples based on its morphological characteristics. The photographs or documentation that was captured served as a visual data for this study and for comparison of an existing herbaria plant identification and classification.

## 4. RESULTS AND DISCUSSION

### 4.1. Location and Topography of the Study Area

The study was conducted at P6 Barangay Bangcud, Malaybalay City, Bukidnon and is situated at latitude (8.051505) and longitude 124.922997 on the map of the Philippines. It has an area of 500 sq. km. or approximately 1 hectare wide and is known for its crystal clear and cool waters which makes an ideal habitat for the mosses to grow and proliferate. To assess the species diversity of moss flora at the vicinity of Matin-aw Spring, Bangcud, Malaybalay City, Bukidnon, an alpha taxonomy or transect walk was employed. The mosses that were collected was carefully examined, identified, and described based on their morphological

characteristics, habitat preferences including its conservation status. To aid the identification and classification, magnifying or field lens and a microscope was used.

### 4.2. Species Richness of Moss Flora

A diverse species of mosses was collected in the study area, with different morphological characteristics observed among the families. Results of the study revealed a total of thirteen (13) species of moss belonging to nine (9) families and eleven (11) genera were identified as shown in Table 1. Of the species identified, one (1) species is considered to be very rare as seen in the area while the others were found several while others are abundant. The researchers also observed that mosses in the area are mostly abundant in the surface of rocks and others in the bark and base of trees due also to its favorable conditions and ideal cool temperature but mostly is of the same species collected scattered around the vicinity of Matin-aw Spring

Table 1: Summary of the total number of moss families, genera and species collected at the vicinity of Matin-aw Spring, Bangcud, Malaybalay City, Bukidnon.

Sample	Family	Genera	Species
13	9	11	13

The moss species collected and identified around the vicinity of Matin-aw Spring, Bangcud Malaybalay City, Bukidnon is shown in Table 2. Findings revealed that among the thirteen (13) species identified belongs to nine (9) different families. Of these thirteen (13) species, three (3) species namely: Vesicularia reticulata (Dozy & Molk.) Broth, Ectropothecium monumentorum (Duby) Jaeg and Vesicularia montagne (Bel.) Broth belongs to the family Hypnaceae were collected. Furthermore, two (2) species namely, Thuidium investe (Mitt.) Jaeg. and Pelekium Velatum Mitt. belongs to the family Thuidiaceae has been collected. Also, two (2) species identified belongs under the family Bartramiaceae namely, Philonotis imbricatula mitt. and Philonotis laxissima (C.M.) Bryol. Jav. Family Rhacopilaceae has one (1) species collected named, Rhacopilum schmidii (C.M.) Jaeg. Moreover, Fissidens guangdongensis iwats. & Z. was also collected which belongs to family Fissidentaceae. Family Pottiaceae has also one (1) species collected

named, *Hyophila involuta* (Hook.) A. Jaeger. Another family of Entodontaceae has also one (1) species collected, named *Entodon Bandongiae* (C.M.) Jaeg. Another one, *Mitthyridium Repens* (Harv.) Robins has been also collected which belongs to family Calymperaceae. Lastly, one (1) species was identified under the family Leucobryaceae named *Octoblepharum Albidum* (Hedw.) a species that is considered very rare in the area.

Table 2. Summary of the Family, Genus and Species of moss flora collected at the vicinity of Matin-aw Spring, Bangcud, Malaybalay City, Bukidnon.

Family	Genera	Species
Hypnaceae	<i>Vesicularia</i> <i>Ectropothecium</i> <i>Vesicularia</i>	<i>reticulata</i> (Dozy & Molk.) Broth <i>monumentorum</i> (Duby) Jaeg. <i>montagne</i> (Bel.) Broth.
Thuidiaceae	<i>Thuidium</i> <i>Pelekium</i>	<i>investe</i> (Mitt.) Jaeg. <i>velatum</i> Mitt.
Bartramiaceae	<i>Philonotis</i> <i>Philonotis</i>	<i>imbricatula</i> Mitt. <i>laxissima</i> (C.M.) Bryol. Jav.
Rhacopilaceae	<i>Rhacopilum</i>	<i>schmidii</i> (C.M.) Jaeg.
Fissidentaceae	<i>Fissidens</i>	<i>guangdongensis</i> Iwats. & Z.
Pottiaceae	<i>Hyophila</i>	<i>involuta</i> (Hook.) A. Jaeger
Entodontaceae	<i>Entodon</i>	<i>bandongiae</i> (C.M.) Jaeg.
Calymperaceae	<i>Mitthyridium</i>	<i>repens</i> (Harv.) Robins
Leucobryaceae	<i>Octoblepharum</i>	<i>albidum</i> (Hedw.)

The provided information of each species has a description derived from the observed morphological characteristics and distinguishing features of each species using field or magnifying lens and a microscope. The following described the moss species that have been examined.

*Vesicularia reticulata* (Dozy & Molk.) Broth

Figure 1

Description: It has a yellowish green leaf color, a triangular or lanceolate leaves with a pointed apex and a broader base, resembling a Christmas tree branch. The leaves are generally small in size with entire margins. They are arranged alternately along the stem.

Ecology: On the surface of rock and in wet environment; Lat 7° 59'45'' N, Long 125° 8' 9" E

Conservation Status: Least Concern

*Ectropothecium monumentorum* (Duby) Jaeg.

Figure 2

Description: It has a yellowish green leaf color and a lanceolate or oblong leaves that are small to medium-sized. The leaves have serrated margins, an acute apex, and a rounded or slightly cordate base. They are arranged alternately along the stem.

Ecology: On the surface of rock and in dry environment; Lat 7° 59' 45'' N, Long 125° 8' 9" E

Conservation Status: Not Listed

*Vesicularia montagne* (Bel.) Broth.

Figure 3

Description: It has yellowish green leaf color and a small lanceolate leaf measuring around 1 to 2 centimeters in length. The leaves have smooth margins, an acute apex, and a rounded or slightly cordate base. They are arranged in pairs along the stem in an opposite fashion.

Ecology: On the surface of rock and in wet environment; Lat 7° 59' 44''N, Long 125° 8' 8" E

Conservation Status: Not Listed

*Thuidium investe* (Mitt.) Jaeg.

Figure 4

Description: It has a green leaf color and a lanceolate or oblong-shaped leaves that are small to medium-sized. The leaf margins are serrated or toothed, while the apex is acute and the base is rounded or slightly cordate. The leaves are arranged in an alternate pattern along the stem.

Ecology: On the surface of rock and in dry environment; Lat 7° 59' 43'' N, Long 125° 8' 4" E

Conservation Status: Not Listed

*Pelekium velatum* Mitt.

Figure 5

Description: It has a green leaf color and a lanceolate to ovate-lanceolate leaves, which are longer than wide and taper to a point. The leaves are small, typically 2-3 mm in length, with finely toothed (serrulate to serrate) margins. The apex of the leaves ranges from acuminate to acute, and the base is decurrent, extending downward along the stem. The leaves are arranged in a densely imbricate pattern, overlapping like tiles.

Ecology: On the bark of tree and in dry; Lat 7° 59'45" N, Long 125° 8' 9" E

Conservation Status: Not Listed

*Philonotis imbricatula* Mitt.

Figure 6

Description: It has a yellowish green leaf color and a lanceolate or linear-lanceolate leaves that are small in size. The leaves have entire margins, an acute apex, and a rounded or slightly cordate base. They densely arrange themselves in an imbricate pattern, creating a scale-like appearance.

Ecology: On the base of tree and in wet environment; Lat 7° 59'45" N, Long 125° 8' 9" E

Conservation Status: Not Listed

*Philonotis laxissima* (C.M.) Bryol. Jav.

Figure 7

Description: It has a yellowish green leaf color. Leaves are typically ovate-lanceolate, measuring around 1.5-2.5 mm in length. They feature serrate to dentate margins and have an apex that is acute to acuminate. The leaf base is somewhat sheathing or decurrent, meaning the leaf margins extend slightly down the stem. The leaves are densely packed and erect, spreading out from the stem, giving the plant a bushy appearance.

Ecology: On the surface of rock and in wet environment; Lat 7° 59'45" N, Long 125° 8' 9" E

Conservation Status: Not Listed

*Rhacopilum schmidii* (C.M.) Jaeg.

Figure 8

Description: It has an evergreen leaf color and a lanceolate or narrowly oblong leaves that are

small in size. The leaves have entire margins, an acute apex, and a rounded or slightly cordate base. They are arranged in an alternate pattern along the stem.

Ecology: On the surface of rock and in dry environment; 7° 59' 45" N, Long 125° 8' 11" E

Conservation Status: Least Concern

*Fissidens guangdongensis* Iwats. & Z.

Figure 9

Description: It has a green leaf color and a lanceolate or narrowly spatulate leaves that are small in size. The leaves have serrated margins, an acute apex, and a rounded or slightly cordate base. They are arranged alternately along the stem.

Ecology: On the surface of rock and in wet environment; 7°, 59' 47" N, Long 125° 8' 8" E

Conservation Status: Not Listed

*Hyophila involuta* (Hook.) A. Jaeger

Figure 10

Description: It has a green leaf color and a linear or lanceolate leaves that are small to medium-sized. The leaves have entire margins, an acute apex, and a rounded or slightly cordate base. They are arranged alternately along the stem.

Ecology: On the surface of rock and in wet environment; Lat 7° 59' 47" N, Long 125° 8' 8" E

Conservation Status: Not Listed

*Entodon bandongiae* (C.M.) Jaeg.

Figure 11

Description: It has a yellowish green leaf color and a lanceolate or oblong leaves that are small to medium-sized. The leaves have serrated margins, an acute apex, and a rounded or slightly cordate base. They are arranged alternately along the stem.

Ecology: On the surface of rock and in dry environment; Lat 7° 59' 43" N, Long 125° 8' 6" E

Conservation Status: Not Listed

*Mitthyridium repens* (Harv.) Robins

Figure 12

Description: Plants small, yellowish green forming less compact mats with short branches. Stem creeping. Leaves oblong and very short (< 2mm), contorted and crispate when dry. Cells of lamina rounded, chlorophyllose and papillose. Small size, broad boarder bearing sharp, spreading teeth are distinct characters. Gemmae sparse, green in colour on both sides of the leaf apex. (Ruklani and Rubashinghe, 2015)

Ecology: On the surface of rock and in dry environment; Lat 7° 59' 42" N, Long 125° 8' 5" E

Conservation Status: Not Listed

*Octoblepharum albidum* (Hedw.)

Figure 13

Description: It has a pale green leaf color and an ovate or elliptical leaves that are small in size. The leaves have entire margins, an acute apex, and a rounded or slightly cordate base. They are arranged in pairs along the stem in an opposite pattern. (Poe.com)

Ecology: On the bark of tree and in moist environment; Lat 7° 59' 45" N, Long 125° 8' 9" E

Conservation Status: Not Listed

### 4.3. Assessment

To evaluate the current status of the moss species found at the vicinity of Matin-aw Spring, Bangcud Malaybalay City, Bukidnon, the method used by Azuelo et al (2019) was utilized. This method involves counting the patches of the moss species habitat to determine their abundance and rarity. Any species found in five or more clumps were considered abundant, while those found in four or fewer clumps were classified as rare in the collection area.

Table 3: Summary of the assessment of identified moss species at the vicinity of Matin-aw Spring, Bangcud Malaybalay City, Bukidnon

Species Name	Local Assessment	Habitat	Status
<i>Vesicularia reticulata</i> (Dozy & Molk.) Broth	Abundant	Rock	Least Concern
<i>Ectropothecium monumentorum</i> (Duby) Jaeg.	Abundant	Rock	NL

<i>Thuidium investe</i> (Mitt.) Jaeg.	Abundant	Rock	NL
<i>Rhacopilum schmidii</i> (C.M.) Jaeg.	Rare	Rock	Least Concern
<i>Fissidens guangdongensis</i> Iwats. & Z.	Rare	Rock	NL
<i>Vesicularia montagne</i> (Bel.) Broth.	Abundant	Rock	NL
<i>Hyophila involuta</i> (Hook.) A. Jaeger	Rare	Rock	NL
<i>Entodon bandongiae</i> (C.M.) Jaeg.	Abundant	Rock	NL
<i>Mitthyridium repens</i> (Harv.) Robins	Abundant	Rock	NL
<i>Philonotis imbricatula</i> Mitt.	Rare	Tree Base	NL
<i>Philonotis laxissima</i> (C.M.) Bryol. Jav.	Rare	Rock	NL
<i>Octoblepharum albidum</i> (Hedw.)	Rare	Tree Bark	NL
<i>Pelekium velatum</i> Mitt.	Rare	Tree Bark	NL

Note: NL (Not Listed)

Of the thirteen (13) species of moss collected in the study area, six (6) were considered abundant including, *Vesicularia Reticulata* (Dozy & Molk.) Broth, *Ectropothecium Monumentorum* (Duby) Jaeg., *Thuidium Investe* (Mitt.) Jaeg., *Vesicularia Montagne* (Bel.) Broth., *Entodon Bandongiae* (C.M.) Jaeg., and *Mitthyridium Repens* (Harv.) Robins while seven (7) others were categorized as rare namely, *Rhacopilum Schmidii* (C.M.) Jaeg., *Fissidens Guangdongensis* Iwats. & Z., *Hyophila Involuta* (Hook.) A. Jaeger, *Philonotis Imbricatula* Mitt., *Philonotis Laxissima* (C.M.) Bryol. Jav., *Octoblepharum Albidum* (Hedw.) and *Pelekium Velatum* Mitt.

The study identified the distribution of moss species at the vicinity of Matin-aw Spring, Bangcud Malaybalay City, Bukidnon by

categorizing them in their specific habitats. Three (3) distinct habitats were identified including rock, tree base and tree barks. Data shown in Table 3 indicate that most of the moss species collected in the area was found on the surface of rocks while two (2) species were found on the tree barks and only one (1) species was found on the tree base.

Based on the information obtained from the International Union for Conservation of Nature (IUCN), scientific journals, and various websites, an assessment of the conservation status of species of moss collected at the vicinity of Matin-aw Spring, Bangcud Malaybalay City, Bukidnon has been recorded. *Vesicularia reticulata* is currently listed on the IUCN Red List as "Least Concern" (LC). This indicates that the species has been evaluated and does not qualify as critically endangered, endangered, vulnerable, or near threatened, suggesting it faces a low risk of extinction at present. The species is noted for its adaptability and is commonly used in aquascaping due to its attractive growth patterns and resilience. At the same time, *Rhacopilum schmidii* is currently listed as "Least Concern" on the IUCN Red List. This indicates that it is not facing a significant risk of extinction at this time. The species is noted for its adaptability and is commonly used in aquascaping due to its attractive growth patterns and resilience. On the other hand, *Fissidens guangdongensis* was described by Iwatsuki and Z.H. Li, is currently not listed in the IUCN Red List. This means that it has not been evaluated for its risk of extinction under the IUCN criteria. *Vesicularia montagne* does not also currently have an assessment listed on the IUCN Red List. This species, often used in aquariums for its aesthetic appeal, has not been evaluated for its risk of extinction by the IUCN, meaning it falls under the category of "Not Evaluated". Additionally, *Hyophila involuta* has not been specifically evaluated on the IUCN Red List. This means it does not have an official IUCN conservation status at this time. However, it is considered a species of "special concern" in regions like Minnesota due to its rarity and specific habitat requirements. Also, *Entodon bandongiae* has not been evaluated by the IUCN Red List, meaning it does not currently have an official conservation status. This species, like many lesser-known mosses, may not have comprehensive data available for a formal assessment. The same with, *Mitthyridium repens*

which is currently not listed on the IUCN Red List. This means it has not been evaluated for its risk of extinction under the IUCN's criteria and does not have an official conservation status. Also, with *Philonotis imbricatula* Mitt. which hasn't been assessed by the IUCN. Their database should have the most recent information on its conservation status. *Philonotis laxissima* has not also been assessed by the IUCN Red List. Next is, *Octoblepharum albidum*, this species does not appear to have been evaluated individually on the IUCN Red List as of the latest available data. *Ectropothecium monumentorum* (Duby) Jaeg. and *Thuidium investe* (Mitt.) Jaeg. was also tagged as not listed. Lastly, we have *Pelekium velatum* currently does not have a specific assessment on the IUCN Red List. This means that it has either not been evaluated or there is no available published data regarding its conservation status on the IUCN's official site.

#### 4.4. Photo Documentation

The specimens were collected at the vicinity of Matin-aw Spring, Bangcud, Malaybalay City, Bukidnon on the 9th and 13th day of April 2024. Photo documentations were done on the collected species of moss at the vicinity of Matin-aw Spring. In addition, the taxonomic keys of moss were used in the identification of moss species with their corresponding morphological characteristics followed by the confirmation of samples done by, Dr. Andrea G. Azuelo, a bryologist. The following morphological features of each species was described above, namely: leaf color, leaf shape, leaf size, leaf margins, leaf apex, leaf base and leaf arrangement.



Figure 1: Morphological features of *Vesicularia reticulata* (Dozy & Molk.) Broth



Figure 2: Morphological features of *Ectropothecium monumentorum* (Duby) Jaeg.



Figure 3: Morphological features of *Thuidium investe* (Mitt.) Jaeg.



Figure 4: Morphological features of *Rhacopilum schmidii* (C.M.) Jaeg.



Figure 5: Morphological features of *Fissidens guangdongensis* Iwats. & Z.



Figure 6: Morphological features of *Vesicularia montagne* (Bel.) Broth.



Figure 7: Morphological features of *Hyophila involuta* (Hook.) A. Jaeger



Figure 8: Morphological features of *Entodon bandongiae* (C.M.) Jaeg.

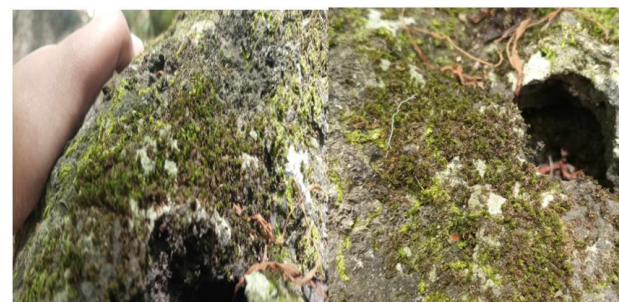


Figure 9: Morphological features of *Mitthyridium repens* (Harv.) Robins



Figure 10: Morphological features of *Philonotis imbricatula* Mitt.



Figure 11: Morphological features of *Philonotis laxissima* (C.M.) Bryol. Jav.



Figure 12: Morphological features of *Octoblepharum albidum* (Hedw.)



Figure 15: Morphological features of *Pelekium velatum* Mitt.

## 5. CONCLUSION AND RECOMMENDATIONS

Based on the floristic inventory of species diversity of moss at the vicinity of Matin-aw Spring, Bangcud, Malaybalay City, Bukidnon. A total of thirteen (13) species belonging to nine (9) families and eleven (11) genera. Of these, six (6) species were abundant while the remaining seven (7) was categorized as rare. This study also revealed that most of the species of moss were confined on the surface or wall of rocks as their distinct habitat where ten (10) of them was categorized. Two (2) species are found on the bark of trees while one (1) species is on the tree base. On conservation status, thirteen species were identified. Two (2) were categorized as “least concern” while the eleven (11) others were categorized as “not listed or not evaluated”. Hence, the researchers suggest that the administration managing Matin-aw Spring must adopt conservation measures and will enforce policies and guidelines for the protection and conservation of these important species specially that a lot of visitors can freely come to visit and enjoy the place for swimming, picnic including laundry.

From the results of this study, it is necessary to conduct regular monitoring and assessment of the moss species present in the area, as well as their population dynamics, to track any changes or threats to their diversity. This study will provide valuable insights into the health of the ecosystem and help inform future conservation efforts. Additionally, it is recommended to collaborate with local communities, conservation organizations, and relevant government agencies to raise awareness about the importance of moss species and their role in maintaining ecological balance. Public education programs, workshops, and outreach activities can be organized to promote the conservation of moss and encourage sustainable practices among the local community. Furthermore, the establishment of protected areas or conservation zones around Matin-aw Spring would provide legal safeguards and ensure the long-term preservation of the moss species and their habitat. Lastly, further research may be conducted to investigate the potential medicinal, ecological, and economic benefits associated with the moss species found in the area. This will not only contribute to scientific knowledge but could also provide opportunities for sustainable utilization and economic development, while

promoting the conservation of this unique moss diversity.

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