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Bazzania genus of Marchantiophyta in the Batang Toru Forest, North Sumatra, Indonesia

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ABSTRACT

This study aims to enhance the existing knowledge on the diversity of liverworts within the genus *Bazzania* in Indonesia, specifically in North Sumatra, where such research is relatively limited. North Sumatra offers a rich habitat for liverworts, particularly within the Batang Toru forest, which experiences extremely high rainfall, resulting in optimal humidity for liverwort growth, including *Bazzania* species. The goal of this study is to contribute to the literature regarding *Bazzania* found in the Batang Toru forest. Sample collection involved exploring the hiking trails of the Batang Toru Forest as part of an exploration survey. *Bazzania* specimens were collected directly from leaves and cut from bark, rocks, or soil using a knife. All collected *Bazzania* liverworts were placed in designated dry specimen envelopes. This research successfully identified 13 *Bazzania* species, three of which are new records for Sumatra: *Bazzania parabidentula, Bazzania parisii,* and *Bazzania scalaris*. The most frequently collected specimens were *Bazzania caudistipula, Bazzania calcarata,* and *Bazzania densa*. The presence of *Bazzania* in the Batang Toru forest indicates that the area remains in a natural state. Consequently, this research aimed to inventory *Bazzania* in the Batang Toru forest and to enhance the understanding of Indonesia's natural wealth, particularly concerning Marchantiophyta.

Keywords: Batang Toru West Block, Division Marchantiophyta, Genus *Bazzania*, North Sumatra, Indonesia

INTRODUCTION

The Batang Toru Forest spans an area of 133,841 hectares. Due to the rupture of the Sumatran fault, this forest is divided into two distinct regional blocks. The western block covers 78,891 hectares, while the eastern block encompasses 54,950 hectares. The Camp Mayang West Block serves as a flora and fauna monitoring station, covering 12,000 hectares between 49°93'31' East Longitude and 18°63'20' North Longitude (Damanik et al., 2022). The climate of the Batang Toru Forest is classified as tropical, characterized by significant rainfall, ranging from 4,500 to 5,000 millimeters annually. Nighttime temperatures may drop to 14°C, while peak daytime temperatures reach 31°C, with humidity fluctuating between 33% and 95%. With very high humidity and rainfall conditions, the Batang Toru Forest is home to various types of plants, including liverwort. Liverwort is widespread in the Batang Toru Forest, found on rotten wood, leaves, soil, and rocks.

Liverworts are widely distributed in lowland and montane forests. (Gradstein et al., 2001). There are about 5,000 types of liverworts, including the genus *Bazzania* (Buczkowska et al., 2010). This group thrives in humid environments, typically in shaded areas, and is often submerged in water or subjected to periodic flooding; predominantly, they inhabit terrestrial regions. (Hallingbäck & Hodgetts, 2000). One type of liverwort that inhabits the aforementioned environmental conditions is the genus *Bazzania*.

Bazzania is a notable genus of liverworts in the Lepidoziaceae family. It is easily recognized by distinctive morphological traits, such as the development of thick mats resembling colonies, a creeping growth habit, and a range of sizes, from small to large variations. (Kabirnataj et al., 2018). It features a delightful forking pattern, frequently referred to as dichotomous branching, which forms an appealing "Y" shape (Breil, 1968). Moreover, *Bazzania* features intercalary branches known as flagella on its ventral side. The leaves are arranged in two lateral rows, with the lower leaves overlapping the upper ones and a row of ventral leaves (Gradstein, 2011; Gradstein, 2017). This genus encompasses approximately 140 species distributed globally, with a primary concentration in the tropical region of Malesia (Cheah & Yong, 2016; Kitagawa, 1977; Kitagawa, 1979; Meijer, 1960; Zhou et al., 2012). These species generally flourish as epiphytes attached to tree trunks and branches. Conversely, particular species prefer acid-rich substrates like forest floor litter and decomposing wood, rarely growing on rocks or sandy soils (Meijer, 1960). Additionally, particular varieties are appreciated for their use as natural dyes and antimicrobials.

Research indicates that around 38 species of the *Bazzania* genus have been found on the island of Sumatra. These species were identified through exploration efforts in several areas, including the Karo Highlands (Berastagi), Mount Singgalang (Padang), Mount Kerinci (Jambi), Bangka, and Mount Sibuatan. This study seeks to locate Marchantiophyta, particularly *Bazzania*, in the Batang Toru forest region and contribute to the literature on *Bazzania* from North Sumatra.

Marchantiophyta is a highly sensitive cryptogam, making it an effective bioindicator for environmental changes. *Bazzania* serves as a forest bioindicator, playing a vital role in sustaining forest ecosystems (Dilrukshi et al., 2024). The diversity of *Bazzania* in the Batang Toru forest reflects the health of a well-preserved forest. However, this condition is primarily found in secondary forest areas. The Batang Toru Forest also faces mining activities, highlighting the importance of this research to gather data on *Bazzania* before it potentially faces extinction due to escalating mining operations.

METHOD

This study took place in the Batang Toru Forest area of the West Block in North Sumatra, Indonesia. The method for gathering moss plants involved an exploratory survey along a specified research route. Moss samples were obtained from natural environments such as soil, tree trunks, decaying wood, and twigs using a knife or pick, and subsequently stored in envelopes. Each envelope included comprehensive details, such as the collector's name, identification number, geographic location, collection date, elevation, habitat characteristics, and specific features like growth patterns, branching types, and colors.

The collected samples were sent to the HERBARIUM MEDANESE laboratory for identification. A binocular light microscope was employed with a 40x magnification to examine the overall habit, and 100x magnification was used for cellular observation. The identified features of *Bazzania* included key morphological traits such as habitat color, lateral leaves (highlighting characteristics like shape, base, pocket, edge, apex, and trigon cells), and under leaves. The identification of *Bazzania* was corroborated by reference books and scientific literature that provided keys and descriptions for the genus suchus (Lestari & Ariyanti, 2017; Meagher, 2019; Thouvenot, 2024; Piippo et al., 2002). Furthermore, the determination of moss specimens was aided by reference materials and scientific sources that offered keys and descriptions for *Bazzania*, particularly those written by Bakalin (2016), Evans (1932), Gradstein (2011), Mizutani & Chang (1986), Mizutani & Chang (1986), Mizutani & Chang (1986), and Zhou et al. (2012).

RESULTS AND DISCUSSION

Research in the Batang Toru Forest, particularly within North Sumatra's West Block, has uncovered 13 unique liverwort genera. Three new records for Sumatra include *Bazzania parabidentula, Bazzania parisii*, and *Bazzania scalaris*. Based on specimen counts, the genera most frequently observed are *Bazzania caudistipula, Bazzania calcarata,* and *Bazzania densa.*

Regarding altitudinal distribution, the 13 genera of *Bazzania* in the Batang Toru Forest and the West Block are classified within the lower montane forest ecosystem. *Bazzania* in the Batang Toru forest thrives at 800 to 1,300 meters above sea level, with most of this genus occurring between 860 and 940 meters.

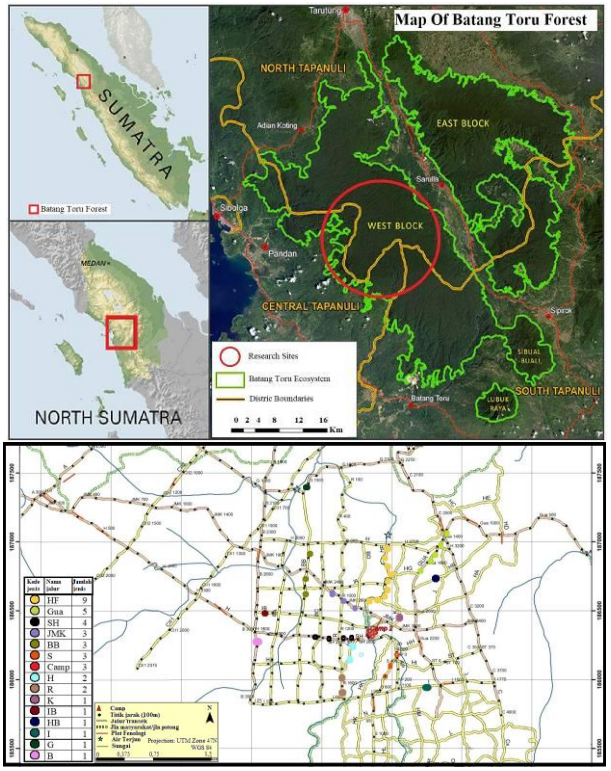

Figure 1. The study area and distribution of the *Bazzania* subfamily along the designated route in the Batang Toru Forest region, especially within the West Block.

Additionally, the spatial distribution of the 13 *Bazzania* genera within the West Block corresponds to various locations along the HF, Gua, SH, JMK, BB, S, Camp Mayang, H, R, K, IB, HB, I, G, and B lines. Notably, these liverworts are most abundant along the HF and Gua routes, where high humidity is maintained due to proximity to river flows and primary forest settings. The study area and map illustrating the distribution of the 13 *Bazzania* genera are provided in Figure 1.

This study's results offer further insights into the diversity of *Bazzania* in North Sumatra. From the characterization findings, a species key can be created to assist in identifying *Bazzania* in the region as follows:

Identification key for the *Bazzania* genus in the Batang Toru Forest Area, North Sumatra

1. a. Stem without flagella……..(*Lepidozia)*
   b. Stem with flagella……(*Bazzania*)
2. a. Ventral leaves are arranged closely together, round, square in shape ……..5 *B. indica*
   b. Ventral leaves are arranged sparsely , round in shape ……..3
3. a. Lateral leaf bases evenly……3 *B. densa*
   b. Lateral leaf bases curved ……..4
4. a. Attachment of lateral leaves to curved stem……2. *B. caudistipula*
   b. Attachment of lateral leaves to evenly……..5
5. a. Ventral leaf shape is square ……..6 *B. japonica*
   b. Ventral leaf shape is rounded ……6
6. a. Ventral leaf attachment on curved stem……..11. *B. praerupta*
   b. Ventral leaf attachment on flat stem……..7
7. a. Ventral leaf margins are serrated……..8
   b. Ventral leaf margins are flat……..12
8. a. Ventral leaf tips split……..9
   b. Ventral leaf tips flat……10
9. a. Cells are polygonal squares ……4. *B.erosa*
   b. Cells are elliptical……..8. *B. paradoxa*
10. a. Cell surface is smooth, trigones are dense……7 *B. parabidentula**
    b. Cell surface is rough, trigons are spaced…..11
11. a. Cell walls are thin, trigones are large……10. *B. pectinata*
    b. Cell walls are thick, trigones are small……..13
12. a. Ventral leaf cells are composed of hyaline cells……13. *B. tridens*
    b. Ventral leaf cells are composed without hyaline cells……..1. *B.calcarata*
13. a. The surface of the lateral leaf cells is smooth……..9. *B. parisii**
    b. The surface of the lateral leaf cells is rough……12 *B. scalaris**

Based on observations from both the field and the laboratory, the following documentation, specifications, distribution, habitat, and ecology

are presented to aid in the identification of *Bazzania* in North Sumatra as follows:

Description of Lepidoziaceae in the Batang Toru Forest Area, North Sumatra

1. ***Bazzania calcarata*** (Sande Lac.) Schiffn.
   Schiffn., Consp. Hepat. Archip. Indici 149 (1898)- *Mastigobryum calaratum* Sde. Lac., Ann. Mus. Bot. Lugd. Bat. 1, 304 (1864).

The body is light green to yellowish green in specimens, with a 2.1-2.9 mm width. Lateral leaves are densely arranged, lanceolate, 1.3-1.7 mm long and 0.3-0.6 mm wide; base flat, leaf attachment to the stem is flat; edge is flat, tip has three teeth, pointed and long; cell shape is rectangular-polygonal, cell wall is thin, cell surface is rough, trigon is rare; Ventral leaves are arranged at a distance, square, 0.6 mm long and 0.4 mm wide, base has an appendix, leaf attachment to the stem is flat, edge is coarsely toothed, tip is split and coarsely toothed in number 6-9 with a cell length of 3-7 cells.

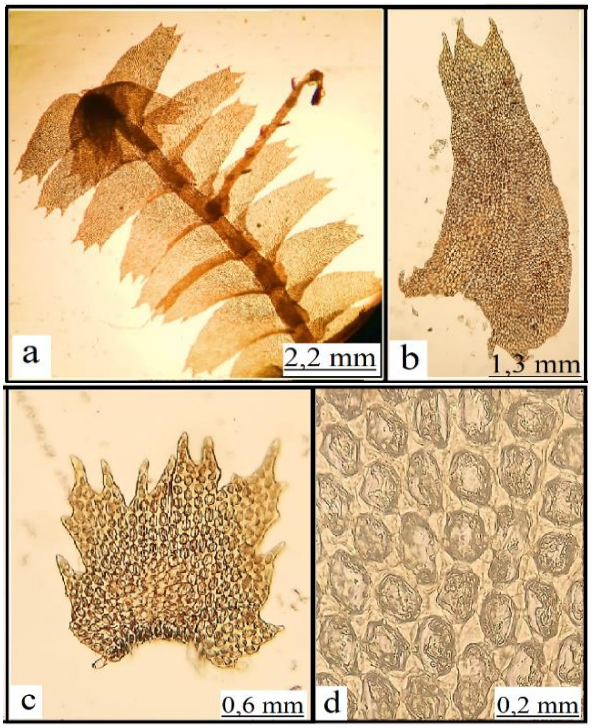

Figure 2. *Bazzania calcarat a* a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells

Specimens Observed: Batang Toru, June 12-17, 2019, RD 323, 340, 511, 641, 809, 1101.

Distribution: Malaysia, Philippines, Indonesia (Sumatra, Java, Kalimantan), Papua New Guinea (Kitagawa, 1979).

Habitat and Ecology: This species is an epiphyte that lives on tree trunks and decomposing wood at elevations ranging from 896 to 1050 meters above sea level. Its environmental conditions include 77-82% humidity and temperatures between 23.2 and 24.6 °C.

2. ***Bazzania caudistipula*** (Steph.) Inoue and H. A. Miller
   Inoue H, Miller HA. *Hepaticae* from Kusaie, Caroline Islands. Bulletin of the National Science Museum, Tokyo (n.ser.) 8, 139–160 (1965).

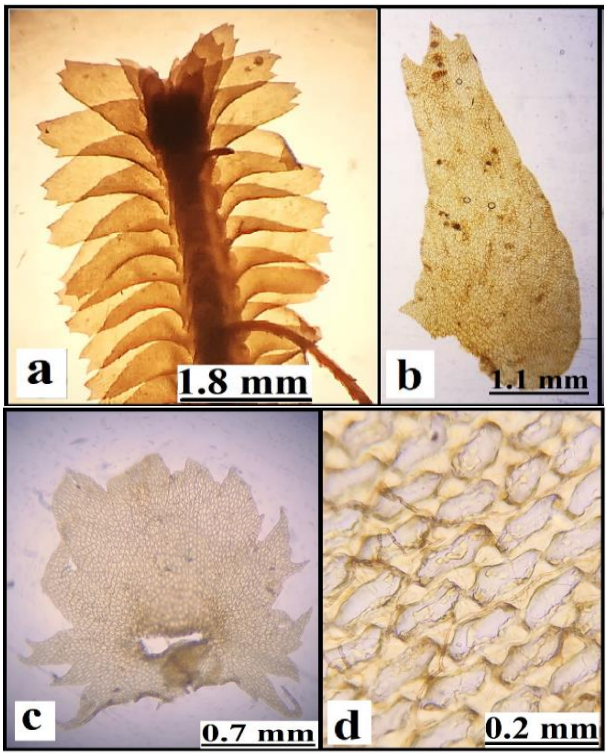

Figure 3. *Bazzania caudistipula* a. Habit (seen from the ventral side) b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells

The appearance is yellowish green to blackish green in specimens; width 3 - 4.4 mm. Lateral leaves are densely arranged, elliptical, 1.7-2.1 mm long and 1.2-1.4 mm wide; the base is flat and notched at one end; leaf attachment to the stem is curved; the edge is flat, the tip has three teeth, pointed and short; cell shape is square polygonal, the cell wall is thick, cell

surface is smooth, trigon is large and spaced; Ventral leaves are densely arranged, square, 0.8-1.2 mm long and 0.5-1.1 mm wide, base has an appendix, leaf attachment to the stem is flat, edge is coarsely serrated, tip has 4-5 teeth and is short.

Specimens Observed: Batang Toru, from June 11 to June 22, 2019, recorded at sites RD 23, 57, 66, 187, 207, 211, 213, 897, 1248, 1787, and 2003.

Distribution: Philippines, Indonesia (including Sumatra, Java, and Borneo), Malaysia, Papua New Guinea, Australia, and Fiji (Meijer, 1960; Kitagawa, 1979).

Habitat and Ecology: This species exists as epiphytes on tree trunks, roots, and decaying wood, found at elevations ranging from 883 to 914 meters above sea level. Its humidity levels range between 81% and 82%, and its temperatures range from 24.1°C to 25.1°C.

3. *Bazzania densa* (Sande Lac.) Schiffin.

Bazzania densa (Sande Lac.) Schiffn., Consp. Hepat. Arch. Ind.: 151, 1898.-*Mastigobryum densum* Sande Lac., Ned. Kruidk Arch. 3, 418, 1854 (1855).

Brownish green plants. Length 1.5-3.2 mm width 0.6-0.9. Lateral leaves are arranged closely, leaf edges are close together, oval-shaped, 0.7-1.6 mm and width 0.4-0.9 mm, leaf base is flat, leaf tip is toothed, pointed and short, polygonal rectangular cells, thin cell walls, smooth cell surfaces, large trigons. Ventral leaves are arranged at a distance, have a round leaf shape, are 0.1-0.4 mm long, 0.2-0.5 mm wide, have a flat base, flat attachment, and flat edge.

Specimens Observed: Batang Toru, 14-19 June 2019, RD 399, 541, 991, 1162, 1315.

Distribution: Philippines, Indonesia (Sumatra, Java, Kalimantan), Papua New Guinea, Australia, Fiji (Cheah & Yong, 2016; Meijer, 1960; Siregar et al., 2018).

Habitat and Ecology: This species acts as an epiphyte on tree trunks and decaying wood. It is typically found at elevations ranging from 863 to 908 meters above sea level, with humidity levels of 83-84% and temperatures between 22.7 and 23.9 degrees Celsius.

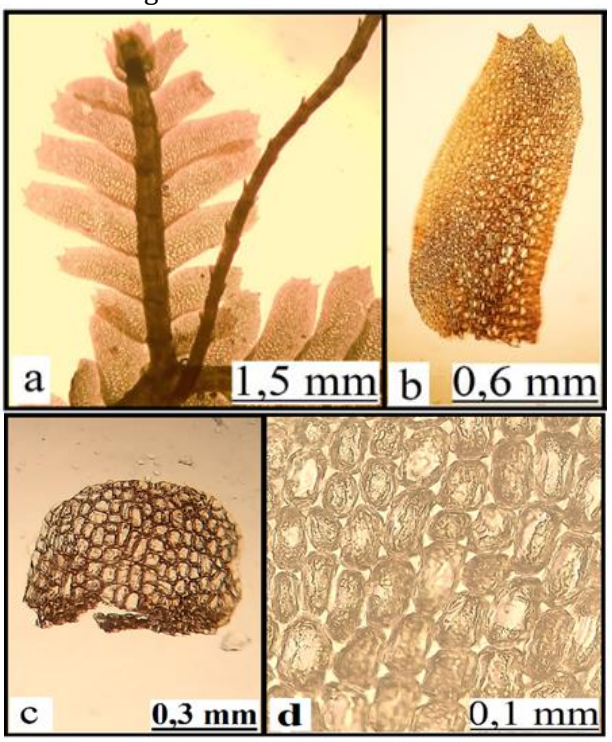

Figure 4. *Bazzania densa* a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells.

4. *Bazzania erosa* (Reinw et al.) Trevis.

Bazzania erosa (Reinw., Bl. Et Nees) Trevis., Mem. Reals 1st. Lombardo Sci. (Ser.3), C.Ci. Mat. 4(13), 415, 1877.-*Jungermannia erosa* Reinw., Blume et Nees, Nova Acta Phys. Med. Acad. Caes. Leop.-Carol Nat. Cur. 12(1), 230, 1824 (1825).

The appearance is light green to brownish yellow in specimens; width 2.8-3.5 mm. Lateral leaves are arranged very closely, oval-elongated, 0.6-2 mm long and 0.4-1.1 mm wide; flat base, leaf attachment to the stem is flat; serrated edge, 3-toothed tip with each end serrated; polygonal, square cell shape, thick cell wall, smooth cell surface, rare trigons. Ventral leaves are arranged very closely, round-square, 0.2-0.4 mm long and 0.3-0.5 mm wide; flat base, leaf attachment to the stem is curved; flat edge surrounds hyaline cells with tippy tip.

Specimens Observed: Batang Toru, 11-14 June 2019, RD 136, 510.

Distribution: Philippines, Thailand, Malaysia, Sabah, Indonesia (Sumatra, Java,

Sulawesi, Halmahera), Papua New Guinea, Australia, and Fiji (Chuach-Petiot, 2011; Kitagawa, 1977; Lai et al., 2008; Meagher, 2013; Meijer, 1960; Soderstrom et al., 2010).

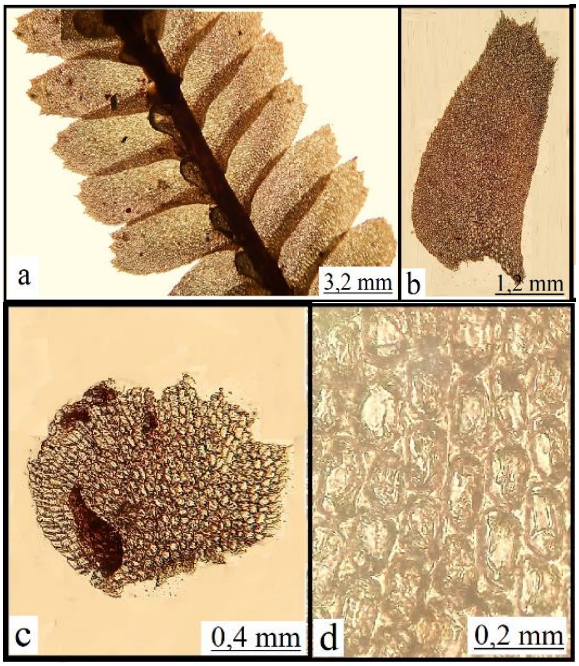

Figure 5. *Bazzania* erosa a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells.

Habitat and Ecology: This species is found as epiphytes on tree trunks and decaying wood at 878-908 meters above sea level. Humidity levels range from 84% to 87%, and temperatures range between 25.2 °C and 26.5°C.

5. *Bazzania indica* (Gottsche and Lindenb.) Trevis.

Bazzania indica (Gottsche et Lindenb.) Trevis., Mem. Reale Ist. Lombardo Sci. (Ser. 3), C.Sci. Mat. 4 (13), 415, 1877. *Matigobryum indicum* Gottsche et al, Lindenb.,Syn Hepat. 2, 230, 1845.

The specimen's appearance is light green to yellowish green; it is 2-2.7 mm wide. Lateral leaves are very densely arranged, oval in shape, 0.7-1.6 mm long and 0.5-0.8 mm wide; flat base, leaf attachment to stem is even; serrated edge, 3-toothed tip with serrated tip; polygonal, rectangular cell shape, thick cell wall, smooth cell surface, rare trigons. Ventral leaves are densely arranged, round to square in shape, 0.2-0.4 mm long and 0.3-0.5 mm wide; flat base, leaf attachment to stem is even; serrated edge, serrated tip.

Specimens Observed: Batang Toru, June 16, 2019, RD 792.

Distribution: Thailand, Malaysia, Singapore and Indonesia (including Sumatra and Java), (Meijer, 1960; Siregar et al., 2021).

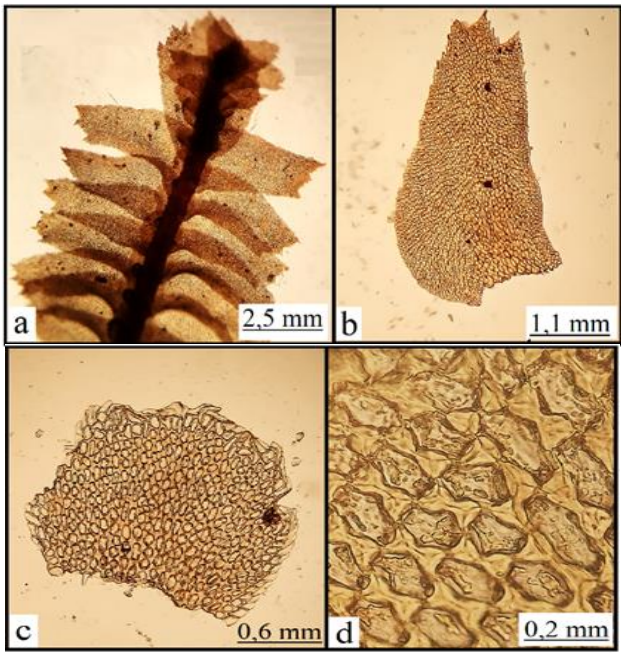

Figure 6. *Bazzania indica* a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells.

Habitat and Ecology: Epiphytes located on tree trunks at an elevation of 908 meters above sea level, with a humidity level of 81% and a temperature of 20.50°C.

6. Bazzania japonica (Sande Lac.) Lindb.

Acta Soc. Sci. Fenn. 10, 224 (1872) *Mastigobryum japonicum* Sande Lac. Ann. Mus. Bot. Lugduno-Batavi 1, 303 (1863).

The appearance is light green to yellowish green in specimens 3-3.6 mm wide. Lateral leaves are densely arranged, oblong, 1.3-1.6 mm long and 0.3-0.7 mm wide; flat base, leaf attachment to stem is even; flat edge, 3-toothed tip, pointed and short; Cells are round-square, cell walls are thin, cell surfaces are smooth, trigones are large. Ventral leaves are closely arranged, square in shape, 0.3-0.4 mm long and 0.2-0.3 mm wide; flat base, leaf attachment to stem is even; rough-toothed edge, rough-toothed tip.

Specimens observed: Batang Toru, June 12, 2019, RD 163.

Distribution: Japan, Korea, Taiwan, Hong Kong, Thailand, Vietnam, and Indonesia (including Sumatra and Java) (Bakalin, 2016; Siregar et al., 2021).

Habitat and Ecology: Epiphytes located on tree trunks at an elevation of 901 meters above sea level, with a humidity of 86% and a temperature of 25.8 °C.

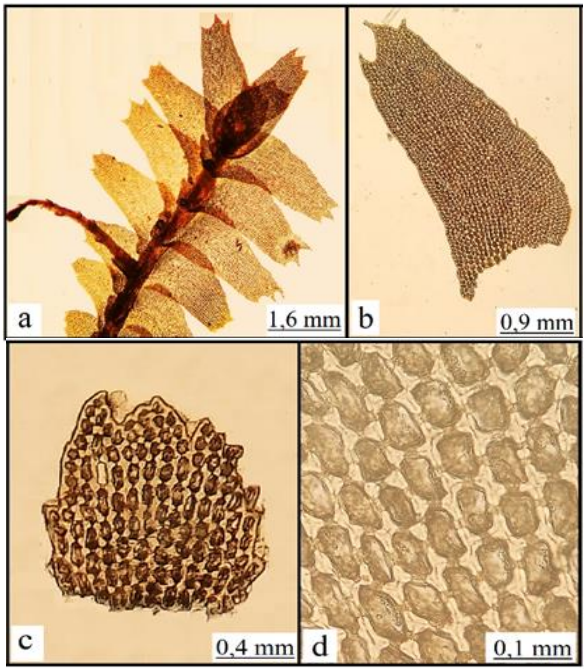

Figure 7. *Bazzania japonica* a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells.

7. *Bazzania parabidentula* Bakalin (Steph.)

W.E. Nicholson in Horik. J. Sci. Hiroshima Univ. Ser. B., Div. 2, 2, 192. (1934). Basionym: *Pleuroschisma bidentulum* Steph. Mém. Soc. Sci. Nat. Math. Cherbourg 29, 222 (1894). (G-00264760!) Holotype: Chi na, Yunnan, leg. 15.VIII.1885, Delavay 484, (probable correct spelling of locality from label: "Col de Lopin-Chan au dessus de Lan-Kong").

The specimen's appearance is yellow to brownish; the width is 1.5-2.1mm. Lateral leaves are arranged very closely, elongated shape, 0.7-1 mm long and 0.3-0.7 mm wide; flat base, leaf attachment to the stem is flat; flat edge, 2-toothed tips forming sinus; square to rectangular cell shape, thick cell wall, smooth cell surface, fairly dense trigon. Ventral leaves are arranged sparsely, round to square, 0.1-0.3 mm long and 0.1-0.25 mm wide; flat base, leaf attachment to the stem is flat; flat edge, curved edge.

Specimens observed: Batang Toru, dated June 13, 2019, RD 340.

Distribution records indicate: Indonesia (notably a new record from Sumatra), Korea, Japan, the Peninsula, and Russia (Bakalin, 2016).

Habitat and Ecology: This species is identified as an epiphyte located on tree trunks at an elevation of 895 meters above sea level. Its humidity level is 82%, and its temperature is 24.1 24.1˚C.

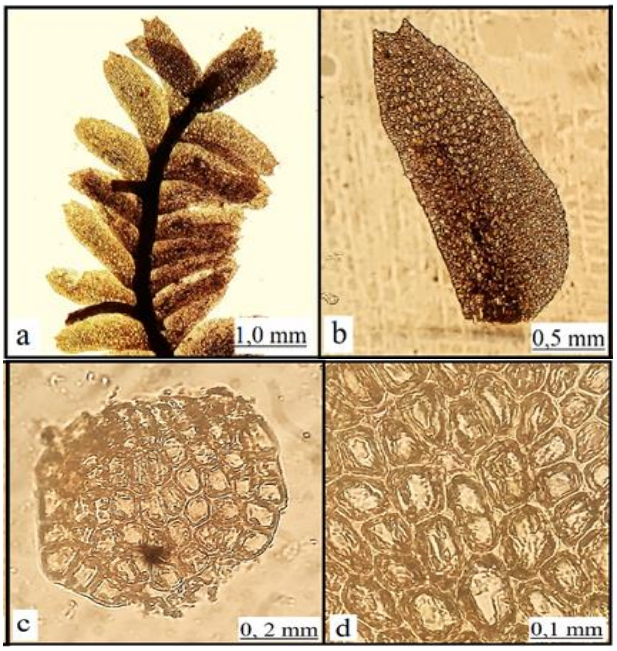

Figure 8. *Bazzania parabidentula* a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells.

8. *Bazzania paradoxa* (Sande Lac.) Steph.

Stephani F. Hepaticae. in: Reinecke F (ed.), Die flora der Samoa Inseln. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeografie pp. 300-316. (1896).

The plant is yellowish green in the specimen; 3.1-3.9 mm wide. Lateral leaves are densely arranged, lanceolate, 1.6-2.3 mm long and 0.9-1.3 mm wide; flat base with one end having an ear, leaf attachment to the stem is curved; flat edge, 2-toothed tip, pointed and long; cell shape is rounded long, cell wall is thick, cell surface is smooth, trigon is large. Ventral leaves

are arranged at a distance, square, 0.6-1.1 mm long and 0.5-0.9 mm wide; flat base and wide like an ear, leaf attachment to the stem is curved; long toothed edge, long toothed tip.

Specimens Observed: Batang Toru, June 20, 2019, RD 1631.

Distribution: The species is distributed across Thailand, Malaysia, Singapore, Indonesia (including Sumatra, Java, and Kalimantan), Fiji, Tonga, and Samoa (Siregar et al., 2018).

Habitat and Ecology: The specimens were found as epiphytes on tree trunks at an elevation of 869 meters above sea level, with a humidity level of 78% and a temperature of 28.1˚C.

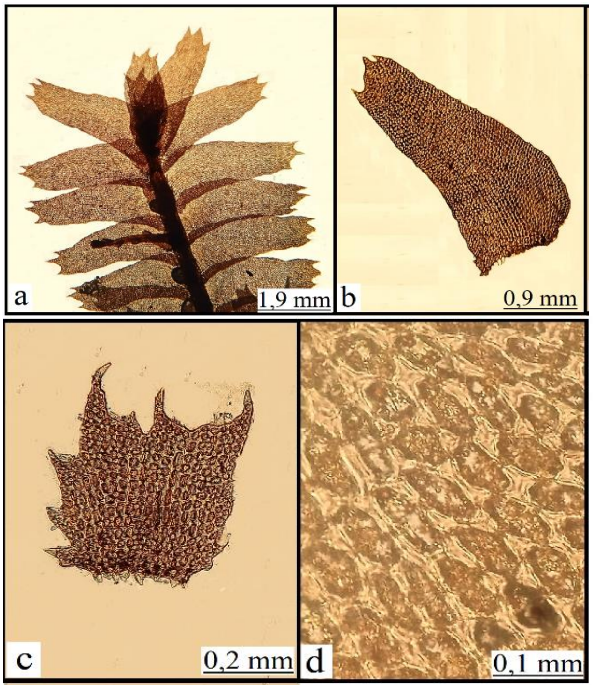

Figure 9. *Bazzania* paradoxa a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells.

9. *Bazzania parisii* (Steph) N. Kitag

Mastigobryum parisii Steph., Bull. Herb. Boisser ser. 28, 769 (1908)= Spec. Hepat. 3 : 453. *Bazzania parisii* (Steph.) N Kitag., J. Hattori Bot. Lab. 47, 135 (1980). Type: New Caledonia, LeRat s.n., undated; holotype G-86889.

The appearance is light green to yellowish on the specimen; width 0.8-2.8 mm. Lateral leaves are arranged closely, elongated, 0.9-1.2 mm long and 0.5-0.8 mm wide; base flat, leaf attachment to stem flat; edge flat, tip has 3 teeth, short and pointed teeth; cell shape is square to oval, cell wall is thick, cell surface is smooth, trigon is close to rare. Ventral leaves are arranged at a distance, rounded, 0.2-0.6 mm long and 0.3-0.45 mm wide; base has horns on ventral and dorsal parts, leaf attachment to stem is curved; rough toothed edge, rough toothed tip.

Specimens Observed: Batang Toru, June 14, 2019, RD 549.

Distribution: Indonesia (new record for Sumatra), Australia, New Caledonia (Kitagawa, 1977).

Habitat and Ecology: This species is found as an epiphyte on tree trunks at an elevation of 908 meters above sea level, with a humidity level of 77% and a temperature of 26.3^{0}C.

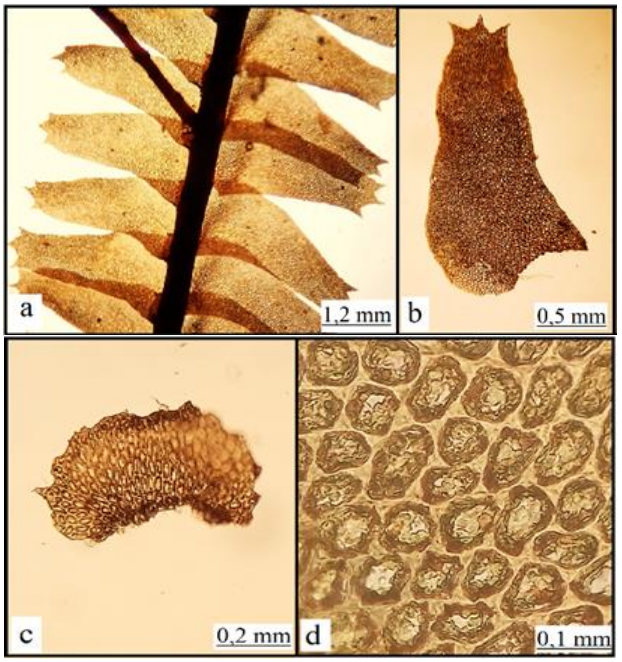

Figure 10. *Bazzania parisii* a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells.

10. *Bazzania pectinata* (Lindenb and Gott.) Schiffn.

(Lindenb. and Gott.) Schiffn., Nova Acta Acad. Ksl. Leop.-Carol. Deut. Akad. Naturf. 60, 259 (1893). Philippines (Bonner and Bischler I977: 809). Luzon, Manila (de Rosario I 977: 124). Mindoro, Mt. Halcon (de Rosario 1967: 361; 1977: 124).

Plants are brownish green on the specimen, 3.5-5.0 mm long. Lateral leaves are densely arranged, lanceolate leaf shape, 2.1-2.9 mm long

and 0.8-1.4 mm wide, curved leaf base, slightly curved leaf attachment, flat leaf edge, leaf tip has 3 long and pointed teeth, polyangonal rectangular cell shape, thin cell wall, rough cell surface, large trigon, ventral leaves are densely arranged, rectangular leaf shape, 0.5-1.4 mm long and 0.8-1.7 mm wide, flat leaf base, left and right appendix attachment, leaf edge has many and short teeth, leaf tip has many and short teeth.

Specimens observed: Batang Toru, June 12-19, 2019, RD 162, 1446.

Distribution: South America, Australia (including Sydney, Melbourne, Hobart, and Perth), Indonesia (specifically Java, Sumatra, Kalimantan, and Maluku), and Thailand (Kitagawa, 1977).

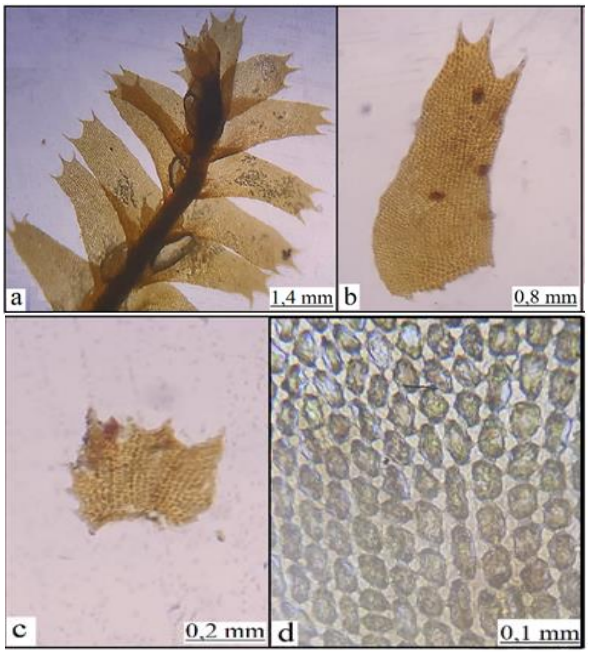

Figure 11. *Bazzania* pectinata a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells

Habitat and ecology: specimens were found as epiphytes on tree trunks at elevations ranging from 893 to 901 meters above sea level, with humidity levels measured at 82-86% and temperatures varying from 25.8 to 26.5˚C.

11. *Bazzania praerupta* (Reinw. et al) Trevis

Bazzania praerupta (Reinw., Blume et Nees) Trevis., Mem. Reale Ist. Lombardo Sci. (Ser. 3), C. Sci. Mat. 4 (13), 414, 1877 (Trevisan 1877). Synonym: *Jungermannia praerupta* Reinw.

The appearance is light green to yellowish on the specimen; width 0.8-2.7 mm. Lateral leaves are arranged closely, oval-elongated, 0.9-1.7 mm long and 0.5-1 mm wide; base is flat, leaf attachment to the stem is flat; edge is flat, tip has 3 teeth, teeth are short and pointed; cell shape is square to oval, cell wall is thick, cell surface is smooth, trigon is dense to sparse. Ventral leaves are arranged at a distance, rounded in shape, 0.2-0.45 mm long and 0.4-0.67 mm wide; base has horns on the ventral and dorsal parts, leaf attachment to the stem is curved; rough toothed edge, rough toothed tip.

Specimens observed: Batang Toru, June 11-19, 2019, RD 80, 514, 765, 1268.

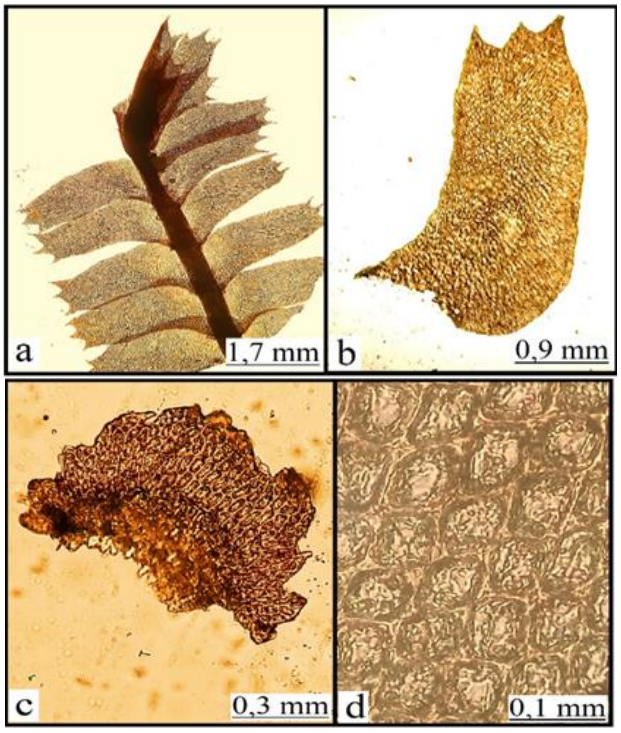

Figure 12. *Bazzania* praerupta a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells

Distribution: Hawaii, Nepal, India, Assam, Myanmar, Japan, Taiwan, Thailand, Vietnam, the Philippines, Indonesia (Sumatra, Java, Kalimantan, Sulawesi), Molluscs (Meijer, 1960; Soderstrom et al., 2010), Northern Asia, spread across the Himalayas (Mizutani, 1967; Kitagawa, 1968), Papua New Guinea (Kitagawa, 1980), and

China (Mizutani & Chang, 1986; Zhou et al., 2012).

Habitat and Ecology: Epiphytes on tree trunks and decaying wood at an elevation of 883-937 m ASL, with humidity at 77-86% and temperatures ranging from 21.4 to 23.3˚C.

12. *Bazzania scalaris* Meagher,

Megaher *Bazzania scalaris* sp. nov. (Marchantiophyta: *Lepidoziaceae*) from Papua New Guinea, Telopea 11(3) 246–251.

The body is yellow to brownish in specimens, 1.4-2.5 mm wide. Lateral leaves are arranged closely, elongated, 0.8-1.3 mm long and 0.2-0.6 mm wide; curved base, leaf attachment to the stem is curved; flat edge, 2-toothed tips forming sinuses and deep; Cells in the middle of the leaf are partly larger, smaller near the edge, inner cells are regularly elongated, thick-walled and strongly nodulated, with prominent trigons and rectangular cells, Ventral leaves are arranged sparsely, square, 0.1-0.27 mm long and 0.1-0.28 mm wide; flat base, leaf attachment to the stem is even; flat edge, 3-5 split tips, few flagella, long and thin, thin and sparse leaves. Generative organs were not found.

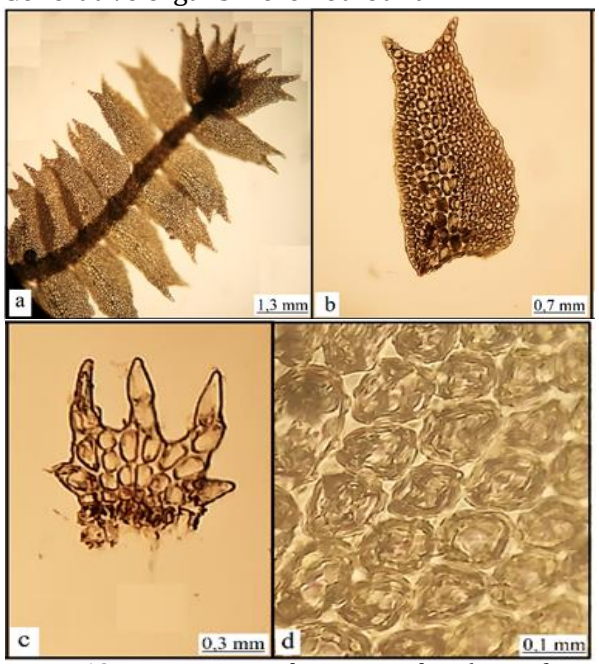

Figure 13. *Bazzania scaliaris* a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells.

Specimens observed: Batang Toru, June 12, 2019, RD 147.

Distribution: Indonesia (new record for Sumatra), Papua New Guinea. (Kitagawa, 1968).

Habitat and Ecology: This organism is an epiphyte located on tree trunks at an altitude of 894 meters, experiencing a humidity level of 96% and a temperature of 22.3^{0}C.

13. *Bazzania tridens* (Reinw. et al.) Trevis.

Type of Mastigobryum tenuistipulum Steph. Makino, T. Japan. G Geneva Herbarium – General Collection (G) G-G-125139/1- *Bazzania tridens* (Reinw., Blume & Nees) Trevis. in GBIF Secretariat (2021); Sonderstrom, *et. al* (2016) World checklist of hornworts and liverworts. PhytoKeys (59),1–828.

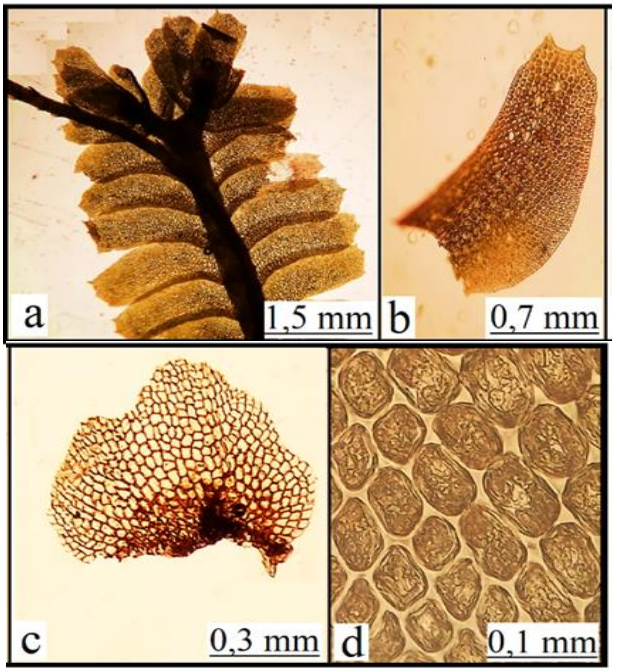

Figure 14. *Bazzania tridens* a. Habit (seen from the ventral side), b. Lateral leaves, c. Ventral leaves, d. Lateral leaf cells.

The appearance is light green to dark green on specimens; 2.2-3 mm wide. Lateral leaves are very densely arranged, oblong-ovate, 0.9-1.5 mm long and 0.3-0.6 mm wide; flat base, leaf attachment to stem is even; flat edge, 3-toothed tip, pointed and short; cells are rectangular-oval, cell walls are thin, cell surface is smooth, trigon is small. Ventral leaves are densely arranged, square, composed entirely of hyaline cells, 0.2-0.5 mm long and 0.2-0.52 mm wide; flat base, leaf

attachment to stem is even; serrated edge, serrated tip.

Specimens observed: Batang Toru, June 16-20, 2019, RD 791, 1636

Distribution: India, Taiwan, Thailand, Vietnam, Malaysia, Singapore, and Indonesia (specifically, Sumatra, Java, Kalimantan, and Sulawesi) (Siregar et al., 2018)

Habitat and Ecology: This species is found as epiphytes on tree trunks at elevations ranging from 861 to 908 meters above sea level, with a humidity level of 84 to 86 percent and temperature fluctuations between 23.7 and 25.8^{0}C

CONCLUSION

The *Bazzania* genus obtained from the Batang Toru Forest is 13 species. Based on the number of collections and direct observations in the field, the most common species found are *Bazzania caudistipula, Bazzania calcarata,* and *Bazzania densa*. After laboratory identification, There was three species were found, which are new recording species from Sumatra, namely (*Bazzania parabidentula, Bazzania parisii, Bazzania scalaris*). The new recording species were found as epiphytes on tree trunks at 860-900 m asl.

REFERENCES

Bakalin, V. A. (2016). A revision of Lepidoziaceae (Hepaticae) in the Russian Far East I. *Bazzania*. *Botanica Pacifica*, *5*(1), 33–52. https://doi.org/10.17581/bp.2016.05108

Breil, D. A. (1968). *Liverworts of the mid Gulf coastal plain: an illustrated manual*. The Florida State University.

Buczkowska, K., Sawicki, J., Szczecińska, M., Klama, H., Milewicz, M., & Czkiewicz, A. B. (2010). Genetic variation in the liverwort *Bazzania* trilobata inferred from ISSR markers. *Journal of Bryology*, *32*(4), 265–274.

Cheah, Y.-H., & Yong, K.-T. (2016). New records of *Bazzania* species (Marchantiophyta: Lepidoziaceae) in Peninsular Malaysia with identification key. *Cryptogamie, Bryologie*, *37*(2), 199–210.

Chuach-Petiot, M. S. (2011). A checklist of Hepaticae and Anthocerotae of Malaysia. *Polish Botanical Journal*, *56*(1), 1-44.

Damanik, R., Pasaribu, N., Siregar, E. S., & Syamsuardi, S. (2022). The family Plagiochilaceae (Marchantiophyta) in Batang Toru Forest, North Sumatra, Indonesia. *Biodiversitas Journal of Biological Diversity*, *23*(6), 3127-3134.

Dilrukshi, H. A. C., Ruklani, N. C. S., & Rubasinghe, S. C. K. (2024). Cryptogams as bio-indicators for ecosystem monitoring in Sri Lanka: a comprehensive review and recommendations. *Environmental Monitoring and Assessment*, *196*(12), 1–14.

Evans, A. W. (1932). Some representative species of *Bazzania* from Sumatra. *Michigan Academy of Science, Arts & Letters*, *17*, 69–118.

Gradstein. (2011). *Guide to the Liverworts and Hornworts of Java*. SEAMEO-BIOTROP.

Gradstein, S. R. (2017). *Bazzania* (Marchantiophyta) in South America. *Nova Hedwigia*, *105*(1–2), 243–266.

Gradstein, S. R., Churchill, S. P., & Salazar-Allen, N. (2001). Guide to the Bryophytes of Tropical America. *Memoirs of the New Botanical Garden*, *86*(January 2001), 1–577.

Hallingbäck, T. & Hodgetts, N. (2000). *Mosses, liverworts, and hornworts: status survey and conservation action plan for bryophytes.* (Vol. 53. G). IUCN in collaboration with the Swedish Threatened Species Unit.

Kabirnataj, S., Nematzadeh, G. A., Talebi, A. F., Tabatabaei, M., & Singh, P. (2018). Neowestiellopsis gen. nov, a new genus of true branched cyanobacteria with the description of Neowestiellopsis persica sp. nov. and Neowestiellopsis bilateralis sp. nov., isolated from Iran. *Plant Systematics and Evolution*, *304*(4), 501–510.

https://doi.org/10.1007/s00606-017-1488-6

Kitagawa, N. (1968). Studies on the hepaticae of Thailand. *Tonan Ajia Kenkyu (The Southeast Asian Studies)*, *6*(3), 608-613.

Kitagawa, N. (1977). Studies on Asian species of *Bazzania*, Hepaticae, I. *Bull. Nara Univ. Edu*, *26*(2), 73–82.

Kitagawa, N. (1979). Studies on Asian Species of *Bazzania*, Hepaticae, Ⅱ. *Bull. Nara Univ. Edu*, *28*(2), 71–83.

Kitagawa, N. (1980). New Guinean species of the genus *Bazzania*, I. *The Journal of the Hattori Botanical Laboratory*, *47*, 127–143.

Lai, M.-J., Zhu, R.-L., & Chantanaorrapint, S. (2008). Liverworts and Hornworts of Thailand: An Updated Checklist and Bryofloristic Accounts. *Annales Botanici Fennici*, *45*(5), 321–341. https://doi.org/10.5735/085.045.0501

Lestari, R. W., & Ariyanti, N. S. (2017). *Bazzania* (Marchantiophyta: Lepidoziaceae) di Taman Nasional Gunung Leuser (Sumatra). *Floribunda*, *5*(7), 227–238.

Meagher, D. (2013). *Lepidoziaceae) from Papua New Guinea*. *11*(3), 246–251.

Meagher, D. A. (2019). A synopsis of the genus *Bazzania* (Marchantiophyta: Lepidoziaceae) in Australia. *Australian Systematic Botany*, *32*(4), 310–362.

Meijer, W. (1960). Notes on the species of *Bazzania* (Hepaticae) mainly of Java. *Blumea: Biodiversity, Evolution and Biogeography of Plants*, *10*(2), 367–384.

Mizutani, M. (1967). Studies of the Himalayan species of *Bazzania*. *J. Hattori Bot. Lab.*, *30*, 71–90.

Mizutani, M., & Chang, K. C. (1986). A preliminary study of Chinese Lepidoziaceae flora. *The Journal of the Hattori Botanical Laboratory*, *60*, 419–437.

Piippo, S., He, X.-L., Juslén, A., Tan, B. C., Murphy, D. H., & Pócs, T. (2002). Hepatic and hornwort flora of Singapore. *Annales Botanici Fennici*, 101–127.

Siregar, E. S., Pasaribu, N., & Nababan, G. (2018). The liverworts family Lepidoziaceae in Aek Nauli Parapat natural forests, North Sumatra, Indonesia. *Journal of Physics: Conference Series, 1116*(5), 052063. https://doi.org/10.1088/1742-6596/1116/5/052063

Siregar, E. S., Pasaribu, N., & Rambe, H. Z. R. (2021). The Liverworts *Bazzania* (Lepidoziaceae) in Sicike-cike Natural Park, North Sumatra, Indonesia. *Journal of Physics: Conference Series, 1819*(1), 012011. https://doi.org/10.1088/1742-6596/1819/1/012011

Soderstrom, L., Gradstein, G., & Hagborg, A. (2010). Checklist of the hornworts and liverworts of Java. *Phytotaxa*, *9*(1), 53–149.

Thouvenot, L. (2024). A revision of the genus *Bazzania* Gray (Lepidoziaceae, Marchantiophyta) in New Caledonia with a review of the type specimens. *Cryptogamie, Bryologie*, *45*(6), 117–154.

Zhou, L.-P., Zhang, L., & Xing, F.-W. (2012). The genus *Bazzania* in China and adjacent regions. I. New species. *Journal of Bryology*, *34*(1), 22–31.