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The Diversity of Liverworts in the Dolok Sordang Sub-District of Sipirok, South Tapanuli, Indonesia

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Abstract : *Research conducted in the village of Dolok Sordang bordering the Natural Reserve of Dolok Sipirok. Found 21 types of liverworts which contains the thalloid liverworts and leafy liverworts. The family has one of the highest types of variation is Lejeuneaceae (6) followed by the Lepidoziaceae (4), Radulaceae (3), Lophocoliaceae (2), Marchantiaceae (2), Plaghiocilaceae (2), Metzegeriaceae (1) and the Aneuraceae (1). These types found on the substrate and elevation. Research data will be used as a reference to see the diversity of types of liverworts in the Natural Reserve of Dolok Sipirok.*
Keywords : *diversity; liverworts; South Tapanuli; Indonesia*

I. Introduction

Bryophyte is greenery, autotroph and a transition between cormus and thalloid plants. Moss can grow on the ground, do not have a network carrier, already has a cell that consists of cellulose (beautiful, 2009). Bryophyta is divided into 4 classes i.e. Bryopsida (Musci), Anthocerotopsida (Anthocerotae), Hepaticopsidae (Hepaticae) and Takakiopsida (Hasan dan Ariyanti, 2004).

In Bryophyte ecological role for the balance of forest ecosystems, i.e., such as peat is very dependent on the lining or cover Moss. So the existence of Lichen as the soil surface cover also affect productivity, community growth and decomposition in the forest. MOSS plants that grow on the forest floor helps reduce the danger of flooding, and able to absorb water in the dry season (Elena, 2011).

The role of the liverworts as indicators of environmental change has been reported in a variety of types of landscape (Holz and Gradstein 2005; Drehwald 2005; Larsen et al. 2007). Several Bryophytes are tolerant of metal and are able to withstand the levels of heavy metals that are toxic to other species. Heavy metals absorbed the atmosphere or substrate. Marchantia polymorpha, Solenostoma crenulata, is an example of metal tolerant populations. Scapania undulata is used to monitor water pollution (Govindapyari et al., 2010). Some other Bryophyte species has also been used as an indicator of air pollution caused by the activities of the community in the area of the settlement, which was polluted by smoke or industry (Dymytrova, 2009).

Research on Moss in Indonesia is still very little. Java has the most reports about MOSS if compared to other regions. Research on the Bryophyta is already done 150 years ago. Spearheaded by the SEAMEO Biotrop by holding training to start from 2001 to 2011. Other regions in Indonesia that already have data about the Bryophyta is Sulawesi. The latest research report that found 340 mosses, liverworts and 2 134 hornworts (Windandri, 2009).

In Sumatra, very little research regarding Moss. Found 490 species of mosses, but there were no reports of liverworts. Publications about liverworts first reported by Sande-lacoste (1884) in Siregar (2015). Research on liverworts in Sumatra is performed by Siregar (2015), the location of the research includes mount Sibayak in North Sumatra Province. Found 163 different species of liverworts in 53 families and 22 ordo. Other studies conducted by Yana (2012) who reported 36 species of mosses which included 19 genus and 15 ordo.

These data indicate that research on especially liverworts, moss is still very limited, especially in the southeastern part of North Sumatra Province.

II. Materials and Methode

This research was carried out in the village of Dolok Sordang area directly adjacent to the nature reserve of Dolok Sipirok. Forest area in the village of Dolok Sordang is representative of the type of vegetation is a tropical rain forest.

Beginning collection mosses using methods exploration of Ruqayah et al. (2014) that is by taking the example of moss in full (there are generation gametophytes and sporofit) as well as other required data noted as habitat, substrate, and color. Sampling collection is done by wrenching the colony following Moss substrate, then insert the paper in the envelope. Other data that needs to be noted among other habitat and substrate for its growth. Drying of specimens is performed by opening envolope. The wind dried specimens are put back in the envelope, ready to pack. Do the recording feature of the morphology, the type of substrate and elevation of each type were found.

III. Result

Found 21 types of liverworts contain the thalloid liverworts and leafy liverworts. The family has one of the highest types of variation is Lejeuneaceae (6) followed by the Lepidoziaceae (4), Radulaceae (3), Lophocoliaceae (2), Marchantiaceae (2), Plaghiocilaceae (2), Metzegeriaceae (1) and the Aneuraceae (1).

Liverworts were found in the village of Dolok Sordang grown on substrates that vary. 4 types of growing on the leaf (*Caudalejeunea reniloba, Cololejeunea heterolobula, Cololejeunea occidentalis, Cololejeunea obtusifolia*), 10 types (*Riccardia limbata, Bazzania nitida, Leptoscyphus infuscatus, Mastigolejeunea virens, Metzegeria leptoneura, Plagiochila dendroides, Plagiochila gracilis, Radula Formosa, Radula javanica, Radula sumatrana*) in the bark and twigs, 2 type (*Marchantia emarginata, Marchantia polymorpha*) in rock and soil, as well as there are 6 types of growing on bark, rocks and land (*Lepidozia redacta,. Lepidozia sucida, Lophocolea martiana, Schiffneriolejeunea tumida, Thysananthus convolutes*).

Based on the height, the liverworts were found are at an altitude not too varied. 11 types (*Caudalejeunea reniloba, Cololejeunea heterolobula, Cololejeunea occidentalis, Cololejeunea obtusifolia, Lepidozia redacta,. Lepidozia sucida, Lophocolea martiana, Schiffneriolejeunea tumida, Thysananthus convolutes, Marchantia emarginata, Marchantia polymorpha*) is found at an altitude of 400-800 meters above sea level, while 10 types *(Riccardia limbata, Bazzania nitida, Leptoscyphus infuscatus, Mastigolejeunea virens, Metzegeria leptoneura, Plagiochila dendroides, Plagiochila gracilis, Radula Formosa, Radula javanica, Radula sumatrana)* is found at an altitude of 800-1400 meters above sea level.

3.2 Species Description

a. Bazzania nitida (Web.) Grolle

Plants green, glossy, shoots up to 1.8 mm wide. Leaves 0.9-1.3 x 0.5-0.7 mm, apex truncate, with 3 short decurved apiculi, with a vitta of 2-4 rows of wide rectangular cells

extending nearly to leaf-apex. Underleaves not much wider than stem, 2-4-lobed to half of their length. Cell walls colorless. **Ecology:** Epiphytic or on dead wood, 1900-2100 m.

b. Caudalejeunea reniloba

Plants 10–15 mm long, 1.8–2.2 mm wide. Cross-section of the stem with epidermis cells larger than medula cells; ventral merophyte 4 cells wide. Leaves imbricate, widely spreading. Leaf-lobe oblong, 1.2–1.5 mm long, 0.5–0.7 mm wide, margin irregularly toothed to entire near the apex; marginal cells of leaf lobe 16–18 x 12–15 µm, mid-leaf cells 45–50 x 25–26 µm, basal cells 35–45 x 35–30 µm; trigones large, cordate. Lobules 1/3 of lobe length, oblong, free margin incurved, apex with 2 teeth, first tooth elongate, with 3–4 cells long, another tooth small, 1-2 cells long. Underleaves contiguous, sometimes becoming enlarged in upper portions of shoots, orbicular to reniform, 0.35-0.5 mm long, 0.4-0.55 mm wide, bases rounded, margin entire and incurved, apex retuse and denticulate to entire. Disciform gemmae produced at the apex of shoots, 7–9 cells wide. Generative structures not seen. Ecology: found on the branch of shrub, at open place in lowland forest. Distribution: Sumatra, Borneo, Moluccas, Seram, West Irian, Papua New Guinea, Peninsular Malaysia, Philippines, Thailand, India, China, Bismark Is., Fiji, Solomon Is., Australia (Mizutani 1988; Gradstein *et al*. 2002).

c. Cololejeunea heterolobula Tixier

Plants small, epiphyllous, densely appressed to a substrate, up to 0.8 mm wide. Stems up to 1 cm long, branched. Lobes ovate, apex rounded, 0.5 mm long and 0.3 mm wide, pseudovitta short, at base of lobe. Lobules saccate, inflated, keel straight, 0.2 mm long and 0.15 mm wide, with 2 teeth, apical tooth unicellular, hardly visible, median tooth 2-cellular, reduced lobules sometimes present. Asexual reproduction with up to 20-celled. Monoicous. Perianths ovoid, apex rounded, with ventral keels and short rostrum, 0.35 mm long and 0.2 mm wide. **Ecology:** Montane forest, epiphyllous, 2000 m.

d. Cololejeunea occidentalis

Plants medium-sized to large, shoots (1.5-)1.8-2 mm wide. Lobe ovate-reniform, c. 0.91.2 x 0.65-0.85 mm, apex broadly rounded, hyaline margin fimbriate, forming a border 1 row wide around most of the lobe, abruptly ending on ventral margin. Lobule ovate, 0.40.55 x 0.25-0.3, distal margin with 2 teeth, the apical tooth with a globose or club shaped hyaline papilla at the side or base of the apical cell. Chlorophyllose cells with smooth cuticle. **Ecology:** Montane forest, epiphyllous, 1700 m.

e. Cololejeunea obtusifolia (E.W.Jones) Tixier

Synonym: *Cololejeunea pusilla* var. *obtusifolia* E.W.Jones. Plants small, shoots 0.5-0.8(-1) mm wide. Leaves approximate, spreading at 50-80° to the stem. Lobe up to 0.4-0.6 mm long, ovate, with broad rounded apex. Lobule reduced to a few (4-8) cells, 36-55 x 22-40 µm. Gemmae on non-marginal lobe cells. Autoicous. Perianth pyriform and terete, 0.4-0.6 x 0.3-0.4 mm, with 5 keels. **Ecology:** Epiphyllous in submontane and the montane forest, 1600-2000 m.

f. Lepidozia redacta

Plants very small and fragile, filamentous, with hair-like leaves, whitish green. Stems "zig-zag"-like. Rhizoids at the base of underleaves, sparse. Leaves transverse, to succubous, leaf lobes biseriate at base, uniseriate filaments distinctly constricted at septa. Underleaves very small, 2-3-lobed. Autoicous. Perianths subcylindrical, eplicate, mouth with few bristle-like lacinia, not constricted. **Ecology:** On rocky slopes in heath forest and on decaying wood or soil in montane forest.

g. Lepidozia sucida

Plants deep green, often forming cushions, stems pinnate or bipinnate. Main stems 2-3 cm long, sometimes stoloniform, branches regularly spaced, complanate or ascending and second. Stem leaves 3-lobed to 0.25 of their length, distant to approximate, 0.5-0.6 mm long, not much longer than wide, branch leaves 2-lobed to 0.25 of their length, oblong, much longer than stem leaves, 0.51 mm long, 1.5-2 x as long as wide, approximate, nearly longitudinally inserted, dorsal margin forming an angle of 45°-80° with the stem. Underleaves mostly 4-lobed, lobed to 0.5 of their length. Dioicous. **Ecology:** Forest floor in dense montane forest, 1800-2000

h. Leptoscyphus infuscatus

Plants brownish, shoots 2.5-3.5 mm wide. Leaves opposite to alternate, patent, convex, rounded or oblong, 1.3-1.8 mm long, ventral margin arched, a dorsal margin less arched, shortly decurrent, apex with 1-3(-4) distant spiniform teeth, each tooth of 2-6 elongate cells. Underleaves free from the leaves or narrowly connate on one or both sides, deeply 2-lobed, the lobes longly acuminate, sinus V-shaped, with 1-4(-6) spinose teeth, short cilia or laciniae on each side. Cells hexagonal, 30-45 µm wide, walls thin, oil bodies 2-3 per cell. Dioicous. Perianths 3 x 1.5-2 mm, strongly inflated at base, mouth bilaterally compressed, truncate, shortly laciniate. **Habitat:** Epiphytic, on litter or on the ground, 1000-1500 m.

i. Lophocolea martiana

Nees Plants medium-sized to large, shoots 2.5-3.5 mm wide. Leaves subsimetric, trapezoid, 1-1.5 mm long, alternate, dorsal base shortly decurrent, truncate at apex, 2-lobed, the lobes shortly acuminate. Cells thin-walled, 30-45 µm wide, trigones absent. Underleaves bilobed, narrowly connate with leaf base, with a tooth on either side. Autoicous. Perianths longly emergent, trigonous above, keels winged, mouth wide, trilobed, lobes laciniate. **Ecology:** On vertical rock, decaying wood and on ground in a montane rainforest, 1800-2100 m.

j. Marchantia emarginata

Thallus narrow, ribbon like; light, yellowish, dull or dark green, with indistinct to distinct median band on dorsal surface; 2.5-5 mm wide. Margin entire, hyaline, reddish or purplish, 2-4 cells wide; thick walled; marginal cell smaller than inner cells. The epidermal cell without papillae. Epidermal pores not cruciate, 40-80 µm in diameter, bordered by 4-7 (8) rings of cells; inner opening bordered by cells with straight or convex inner walls; mucilage cavities absent or sometimes present in compact ventral tissue of thallus. Ventral surface purplish or brown, at least in the median portion; scales in 4 rows extending about

25 to 50 % of thallus width. Median scales reddish or purplish; oil cells scattered. Appendages purplish, sometimes light red or pale brown; ovate; 5-16 (20) cells wide; apex acute or apiculate, with 1-3 cells apically; margin with sharp toothed, 1-2 (3) cells long, often curved towards base of appendage; terminal cells often lighter in colour, area (1-2.5) times smaller than that of inner cells (indistinctly smaller than inner cells). Laminal scales purplish, light red or sometimes hyaline; ovate to orbicular; apex acute or obtuse; oil cells sometimes frequent. Cupules ciliate; cilia 1-4 cells long, 1-2 cell basally; without papillae on the outer surface. Archegoniophore at apex of the main thallus. Stalk 5-14 mm long; scales purplish or light red. Scales surrounding base of stalk with appendage similar to those of median scale or with the acuminate appendage. Receptacle with distinct to indistinct rounded median projection on dorsal surface; 3.5-5 mm in diameter, deeply divided (0.7-0.9) of diameter into 5-11 lobes; nearly symmetric or asymmetric; lobe convex basally, usually broadened, twice emarginate, truncate or sometimes rounded apically; the lobe opposite the basal sinus often wider than the others. Involucres hyaline, entire. Scales of receptacle purplish or sometimes light red or hyaline, lobed or toothed, seldom entire, 3-16 cells wide; apex with a row of 3-7 cells. Spores light brown or brown. Antheridiophore at the apex of thallus. Stalk 5-14 mm long; scales purplish, sometimes hyaline. Scales surrounding base of stalk not differentiated, or with long acuminate appendage. Receptacle palmate, 4-7 mm in diameter, deeply dissected (0.5-0.7 of diameter) into 5-7 rays; asymmetric. Rays with entire or slightly crenulate margins; marginal cells smaller or hardly smaller tahn inner cells. Median cales of ventral surface of rays purplish, sometimes hyaline, with acute appendage, 2-6 cells wide with row of 1-3 cells apically. Ecology: found on soils, rocks (moist, damp or wet, shaded, semi exposed places, riversides, creeks) from 870 to 1450 m altitude. Distribution: Japan, Korea, China, India, Sri Lanka, Andaman and Nicobar Island, Thailand, Malaysia, Sumatra, Java, Borneo, Lesser Sunda Island, Bali, Moluccas, West Irian, Philippines, Marianas, Guam, New Guinea, New Britain, Solomon Island (Bischler-Causse 1989; Bischler-Causse and Piippo 1991; Song 2006; Lai *et al*. 2008; Chuah-Petiot 2011; Singh and Singh 2012).

k. Marchantia polymorpha

Thallus light or yellowish green, with distinct median band on dorsal surface. Margin crenulate. Ventral surface green or pale brown, at least in median portion, with 6 rows of scales extending over entire surface; scales reaching the thallus margin ± visible at the margin in dorsal view. Median scales hyaline.Appendages light red to purplish; orbicular to reniform; margin with sharp, unicellular teeth. Laminal scales hyaline; apex rounded. Marginal scales hyaline or brownish; ovate to oblong; apex obtuse to rounded; margin irregularly crenulate, cell walls in upperpart with thickened angles. Cupules with ciliate lobes; outer surface with numerous papillae. Archegoniophore at apex of main thallus. Stalk up to 40 mm long; scales hyaline. Scales surrounding base of stalk hyaline with light red borders, rounded and crenulate apically, without appendage. Receptacle 8-10 mm in diameter, with 10-11 terete rays; nearly symmetric; dorsal surface without median projection. Involucres with ciliate lobe; reaching 1/3-3/4 of length of rays, hyaline, lobes 6-12 cells long with row of 3-4 cells apically, cilia 1-5 cells, 1-2 cells wide basally. Spores yellow. Antheridiophore at apex of thallus or of short lateral branched. Stalk 8-10 mm long; scales hyaline, without appendage. Receptacle peltate, 5-6 mm in diameter (young antheridium), shallowly dissected (0.1-0.2) of diameter into 6-8 lobes; almost symmetric;

dorsal surface without papillae. Ecology: found on rocks of creek wall in exposed places, at 1500 m altitude. Distribution: Turkey, Syria, Lebanon, Israel, Iraq, Iran, Russia, USSR, Uzbekistan, Tadzhikistan, Afghanistan, Pakistan, India, Sri Lanka, Nepal, Bhutan, China, Taiwan, Korea, Japan, Thailand, Vietnam, Malaysia, Indonesia (Java, Sumatra–new record based on the present study, Irian Jaya), Philippines, New Guinea, New Zealand, Tasmania (Bischler-Causse 1989; Söderström *et al.* 2010; Singh and Singh 2012).

l. Mastigolejeunea virens

Plants up to 12 mm long, 1 mm wide, branched. Ventral merophyte 4 cells wide, stem 0.7 mm wide. Leaves imbricate. Leaf-lobe ovate, 0.6–0.8 mm x 0.5–0.6 mm, margin entire, apex obtuse to rounded; marginal cells of leaf-lobe 6–10 x 6 µm, mid-leaf cells 10–15 x 5–6 µm, basal cells 17–25 x 7–9 µm; trigones date; lobules 1/2 of lobe length, ovate, inflated, apex obliquely truncate with one long tooth consisting of 5–6 cells. Underleaves imbricate, cordate, margin entire, apex truncate. Generative organ not seen. Ecology: found on tree trunk at open place at lowland forest. Distribution: Sumatra (new record), Java, Borneo, Moluccas, Peninsular Malaysia, Papua New Guinea, Philippines, Thailand, Sri Lanka, Pacific Is., Australia (Gradstein *et al*. 2002).

m. Metzegeria leptoneura

Plants green to yellowish-green. Thallus distinctly convex, margins strongly recurved to revolute, c. 10-20 x 0.7-1.2(-2.5) mm when flattened. Thallus margins with geminate, distinctly curved or falcate hairs, ventral surface ot thallus lamina without hairs, ventral surface of midrib with falcate hairs. Midrib equally arched in cross-section, with 2 rows of dorsal cortical cells and 2-3 rows of ventral cortical cells, medullary cells 10-24, thick-walled. Gemmae occasional on thallus margin. Dioicous. **Ecology :** Epiphyte in montane forest, *Hagenia-Hypericum* forest and *Dendrosenecio-Lobelia wollastoni* paramo up to the alpine belt with *Alchemilla* mats, 2000-4200 m.

n. Plagiochila dendroides

Plant yellowish to pale brown in dry specimen, 15–45 mm long, 1.7–2.2 mm wide, stem often with scale-like small leaves; branches very frequent of terminal and *Frullania*-type, forming a dendroid habit, apex of Frullania-type branches frequently elongated and becoming minute-leaved, flagelliform. Leaves remote, lobes ovate-oblong, 0.7–0.9 mm long, 0.4–0.5 mm wide; dorsal margin moderately revolute and shortly decurrent along dorsal stem midline; ventral margin shortly decurrent; apex of lobes with shallowly and asymetrically bilobed, or with 2–(3) teeth; dorsal and ventral margin entire. Leaf cells at middle portion 20–32 µm x 10–13 µm, at leaf-base 25–40 µm x 10–15 µm, at the marginal 17.5–25 µm x 10–12.5 µm; trigones indistinct, cuticle smooth. Underleaves vestigial, filiform. Androecia terminal or intercalary of branches. Gynoecia terminal on branched or intercalary with 1 or 2 innovation; bracts ovate-oblong, 1.2–1.5 mm long, 0.5–0.7 mm wide; perianth 1.5 mm long, 0.5–0.8 mm wide, margin of mouth rounded, with coarsely spinose. Ecology: found on tree trunks from lowland to lower montane forest. Distribution: Japan, Taiwan, Philippines, Malaysia, Sumatra (Mt. Singgalang, Mt. Talang), Java, Borneo, West Irian, Papua New Guinea, New Caledonia, Fiji (Inoue 1958; Inoue 1984).

o. Plagiochila gracilis

Plant small 10–20 mm long, 2.5–3.5 mm wide, yellowish brown in dry specimen; branches very rare, if present exclusively lateral intercalary. Leaves distant to contiguous, lobes oblong–ovate or obovate, widest at or around the middle part, 1.25–1.5 mm long, 0.6–0.8 mm wide; dorsal margin slightly revolute, long decurrent along dorsal margin; ventral margin not decurrent; apex rounded,
with 2–4 teeth wich two are often prominent (when plants are young, the two prominent teeth show a tendency toward bilobing); margin entire on dorsal side, ventral margin with 4–6 teeth on distal half ; teeth on leaf margin 6–10 in total number, triangular, 2–4 cells wide at the base and 2–6 cells long. Leaf cells at middle portion 25–32.5 µm x 12.5–22.5 µm, basal cells 25–40 µm x 12.5–20 µm, marginal cells 22.5–30 µm x 12.5–17.5 µm; trigones medium sized, acute, cuticle smooth. Underleaves very vestigial, filiform, 1–2 cells wide at the base, 2–3 cells long. Generative organ not seen. Ecology: found on tree trunks from lowland to lower montane forest. Distribution: India, Buthan, Nepal, Sri Lanka, China, Japan, Taiwan, Thailand, Philippines, Sumatra (new record based on this study), Java (So 2001; Srivastava *et al.* 2006; Lai *et al.* 2008; Alam 2012).

p. Radula formosa

Plant yellow to brownish in dry specimen, 10–15 mm long, 1.25–1.80 mm wide. Plants with numerous amentulose branches (= tiny leafy branches arising from leaf axils and hardly longer than the leaf), 0.5–0.8 mm long, with 4–6 pairs of small fusiform leaves. Leaf-lobes imbricate, widely spreading, concave, ovatel falcate, 0.7–0.9 mm long, 0.6–0.7 mm wide; margin entire, ventral margin flat, base of dorsal margin fully covering the stem; apex rounded, strongly incurved; trigones very large, nodulose, confluent, cuticle cells smooth; leaf-lobules remote, subquadrate, ca.1/2–2/3 of lobe length, widest in the lower half, apex rounded, incurved, abaxial margin straight to slightly arched, adaxial margin arched, strongly incurved toward the apex, base covering up to 1/2 of stem width; keel straight or sometimes slightly arched, not decurrent, extending at angles of about 50^0 with the stem, 0.3–0.35 mm long, sinus obtuse; rhizoid initial area ± convex, rhizoid not seen. Generative structures not seen. Ecology: found on tree trunks at lowland forest. Distribution: Tahiti, Ceylon, Japan, Philippines, Thailand, Malay Peninsula, Sumatra (without detailed locality), Java, Borneo, Sulawesi, Ceram, Papua New Guinea, Micronesia, Fiji, New Caledonia (Yamada 1979).

q. Radula javanica

Plant green-yellowish in dry specimen, 10–25 mm long, 1.8–2.5 mm wide. Stem 0.1 mm in diameter, with irregularly pinnate branches. Leaf-lobes loosely to moderately imbricate, slightly convex, oblong-ovate, 1.2–1.3 mm long, 0.8–0.9 mm wide, margin entire, base of dorsal margin arched, covering 3/4 of stem width, sometimes fully covering the stem, apex rounded, not incurved; trigones small to medium sized, triangular, cuticle cells smooth; leaf-lobules remote to contiguous, ca.1/3 of lobe length, subquadrate, 0.3–0.4 mm long, 0.2–0.3 mm wide, apex obtuse, abaxial margin straight, adaxial slightly arched, base covering the stem 1/3–3/4 of the stem; keel slightly sinuate, slightly decurrent, 0.3–0.4 mm long, sinus wide, obtuse; rhizoid initial area convex, rhizoid few, brown. Dioicous. Androecia terminal on brances, with 5 pairs of bracts. Gynoecia terminal on branches with one subfloral innovation; bracts obovate, apex rounded;bract-lobule falcate-subrectangular,

keel sinuate; perianth flat cylindric, 2.8–3.3 mm long, 1.1–1.2 mm wide, mouth two-lipped, repand. Ecology: found on tree trunks, tree branches, tree roots, and somewhat on rotten logs from lowland forest to lower montane. Distribution: Ceylon, India, Japan, Taiwan, Philippines, Thailand, Vietnam, Malay Peninsula, Sumatra (Mt. Kerinchi, Taram-east of Pajakumbuh, Mt. Sago), Java, Borneo, West Irian, New Guinea, Central and South America (Yamada, 1979; Yamada and Piippo 1989; Yamada 2000).

r. Radula sumatrana

Plant yellowish-green in dry specimen, 25–55 mm long, 2.5–3.2 mm wide. stem 0.15–0.20 mm in diameter, with irregularly pinnate branches. Leaf-lobes imbricate, flat, ovate, 1.5–1.8 mm long, 1.2–1.3 mm wide, margin entire orsometimes with gemmae, ventral margin flat, base of dorsal margin covering the stem, apex rounded; trigones small, cuticle cells densely verrucose; leaf-lobules large, contiguous to covering each other at upper portion of stem and slightly remote at lower portion, ca.1/3–2/5 of lobe length, subquadrate, 0.4–0.5 mm long, 0.6–0.7 mm wide; apex narrowly to widely obtuse, abaxial margin slightly arched, adaxial margin undulate, covering the stem 1/2–3/4 of the stem width at lower portion and fully covering the stem at upper portion of stem; keel decurrent, 0.5–0.6 mm long, spreading at angles of ca. 40^0–50^0 with the stem, sinus obtuse; rhizoid initial area convex, rhizoid few. Dioicous. Androecia not found. Gynoecia intercalary or terminal on branch with one subfloral innovation; perianth flat cylindric, ca. 3.0–3.75 mm long, 1–1.3 mm wide, mouth truncate, repand. Ecology: found on tree trunks, tree branches and rotten logs at primary and secondary forest, from lowland forest to lower montane forest. Distribution: Thailand, Sumatra (North Sumatra: Sibolangit), Java, Borneo (Yamada 1979).

s. Riccardia limbata

Thallus pinnate or bipinnate, usually 1-2 cm long. Main axes 5-9 cells thick, 0.5-0.9 mm wide, distinctly winged, ultimate branches, 3-4 cells thick with unistratose wings, 2-4 cells wide. Cortical cells in middle of branch 25-35 × 45-90 µm, branches 12-30 µm thick in cross section. Dioicous or sometimes monoicous. Calyptra clavate, c. 2 mm long. **Ecology:** Montane forest, near rivers and streams in valleys, on wet rocks, rotting wood, tree boles, less often on soil, 1900-2400 m.

t. Schiffneriolejeunea tumida

Plants 20–30 mm long, lebar 1.8–2.5 mm wide. Ventral merophyte 6–7 cells wide. Leaves closely imbricate. Leaf-lobe ovate to rounded, 1.4 mm x 1.3 mm, margin entire, rolled inwards along ventral and apical margin; marginal cells of leaf-lobe 9–12 x 9–10 µm, mid-leaf cells 25–30 x 12–15 µm, basal cells 35–37 x 12–15 µm; trigones cordate. Lobules 1/4–1/3 of lobe length, ovate-oblong, margin inrolled, apex truncate, with 2 teeth, first tooth larger than second tooth. Underleaves contiguous to imbricate, obovate to obcordate, 0.6–0.8 mm x 0.4–0.6 mm, apex truncate, often recurved. Androecia not seen. Gynoecia terminal on lateral branches, without innovation. Perianths obovate, with 5 rounded keels. Ecology: found on tree trunks at open place. Some populations were found on cultivated plants. Distribution: Sumatra (new record), West Irian, Papua New Guinea, Thailand, Solomon Is. (Zhu and Gradstein 2005; Kornochalert *et al.* 2012).

u. Thysananthus convolutes

Autoicous. Plants up to 20 mm long, 2.5–3.5, mm wide. Ventral merophyte 4-6 cells wide, diameter of stem 0.6 mm. Leaves closely imbricate. Leaf-lobe 1.5-1.6 x 0.8–1 mm, ovate, distal part recurved, asymmetric, margin entire toothed, apex rounded, recurved; marginal cells of leaf-lobe 9–10 x 6–7 µm, mid-leaf cells 25–30 x 7–10 µm, basal cells 42–47 x 10–13 µm; trigones large,cordate. Lobules 1/3–1/2 of lobe length, ovate, apex truncate, with 2 small teeth.Underleaves imbricate, spathulate, 0.6–1 mm long, 0.4–0.7 mm wide, margin toothed toward apex, lateral margin recurved, apex truncate. Androecia intercalary or terminal on short or long branches; bracts in 6–14 pairs. Gynoecia terminal onmain stem, with 1 innovation. Perianths cylindrical, 1.3–1.5 mm long, with 5 rounded keels. Ecology: found on tree trunks, rotten logs from lowland to lower montan forest. Distribution: Java, Sumatra, Borneo, Sulawesi, Moluccas, Peninsular Malaysia, Papua New Guinea, Philippines, Thailand, Solomon Is. (Haerida *et al.*2010; Kornochalert *et al.* 2012).

IV. Conclusion

Found 21 types of liverworts contains the bertalus liverworts and leafy liverworts. The family has one of the highest types of variation is Lejeuneaceae (6) followed by the Lepidoziaceae (4), Radulaceae (3), Lophocoliaceae (2), Marchantiaceae (2), Plaghiocilaceae (2), Metzegeriaceae (1) and the Aneuraceae (1). Liverworts were found in the village of Dolok Sordang grown on substrates that vary. 4 species of growing on the leaf, 10 species in the bark and twigs, 2 species in rock and soil, as well as there are 6 types of growing on bark, rocks and land. Based on the altitude, the liverworts were found are at an altitude not too varied. 11 species ares found at an altitude of 400-800 meters above sea level, while 10 species is found at an altitude of 800-1400 meters above sea level.

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