



Lejeuneaceae (Marchantiophyta) of Sicike-cike Natural Park, North Sumatra Indonesia

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ABSTRACT: Lejeuneaceae (Marchantiophyta) is still poorly known in Sumatra. This research was conducted to explore the diversity of Lejeuneaceae in Sicike-cike Natural Park, North Sumatra, Indonesia. The species of Lejeuneaceae was observed based on the specimens collected along trails in the study site. The study reveals the occurrence of 29 species, which are: *Acrolejeunea* (1 species), *Cheilolejeunea* (5 species), *Cololejeunea* (2 species), *Colura* (1 species), *Drepanolejeunea* (6 species), *Lejeunea* (6 species), *Leptolejeunea* (1 species), *Lopholejeunea* (4 species), *Metalejeunea* (1 species), *Thysananthus* (2 species). Eight species of these are newly reported for Sumatra. Those are *Cololejeunea stephanii*, *Drepanolejeunea levicornua*, *D. ternatensis*, *D. thwaitesiana*, *D. tricornua*, *Lejeunea obscura*, *Leptolejeunea foliicola*, and *Lopholejeunea herzogiana*. An identification key to the species of Lejeuneaceae from Sicike-cike Natural Park North Sumatra is provided.

KEY WORDS: Liverworts, Lejeuneaceae, North Sumatra, Sicike-cike National Park.

INTRODUCTION

Lejeuneacea is the largest family of liverworts represented by more than a thousand species in 68 currently accepted genera (Gradstein, 2013). The family is found in various habitats such as tree trunks, tree branches, living leaves and rotten logs at the shaded to open places. Lejeuneaceae is an important component of the epiphytic flora of humid tropical and subtropical forests (Wang *et al.*, 2016). Lejeuneaceae can be recognized by the presence of *Lejeunea*-type (sometimes with *Frullania*-type) branches; the presence of underleaves (lacking in *Cololejeunea*), undivided or bifid; lobules attached to the lobe along a keel; oil bodies small, granular or homogeneous (Gradstein, 2011).

Study on the Lejeuneaceae from Indonesia until date is still limited. Some studies on species diversity of Lejeuneaceae in Java were recently published (Haerida 2009; Haerida *et al.*, 2010; Gradstein, 2011). However, the floristic work on Lejeuneaceae in Sumatra, especially North Sumatra is very poor. The first publication of Lejeuneaceae in Sumatra was written by Verdoorn (1933). For some long periods, no floristic work has been carried out on the Lejeuneaceae of Sumatra, until some recent studies such as Schafer-Verwimp (2006), and Siregar *et al.* (2014). So far, there is no other publication about this family from Sumatra. Therefore, study on the Lejeuneacea of Sumatra, especially in North Sumatra is certainly needed.

The study area is in Sicike-cike Natural Park, Dairi District, North Sumatra province, Indonesia (Fig. 1), approximately 170 km from Medan city. The locality has an altitude of about 1250–1400 m above sea level,

annual rainfall of 2000–2500 mm/year, and relative humidity of at least 90–100%. Exploration was carried out along the trails of Sicike-cike Natural Park. All newly acquired specimens are deposited in MEDA herbarium of Biology Department, Faculty of Mathematics and Natural Sciences, University of Sumatra Utara and TAI herbarium of National Taiwan University. An identification key to the species of Lejeuneaceae in Sicike-cike Natural Forest North Sumatra is provided.

TAXONOMIC TREATMENT

A total of 29 species of Lejeuneaceae were identified belonging to 10 genera. Eight species of these (27.58%) are new records for Sumatra. They are *Cololejeunea stephanii*, *Drepanolejeunea levicornua*, *D. ternatensis*, *D. thwaitesiana*, *D. tricornua*, *Lejeunea obscura*, *Leptolejeunea foliicola*, and *Lopholejeunea herzogiana*.

Key to species of Lejeuneaceae in Sicike-cike Natural Park North Sumatra:

- 1 Underleaves lacking (*Cololejeunea*)2
- 1 Underleaves present3
- 2 Lateral leaves without vitta; stylus one cell long
..... 7. *Cololejeunea angustiflora*
- 2 Lateral leaves with vitta; stylus 3 cells long
..... 8. *Cololejeunea stephanii*
- 3 Leaves with an inflated sac at the tip 9. *Colura acroloba*
- 3 Leaves without an inflated sac at the tip4
- 4 Underleaves divided into 2 lobes 5
- 4 Underleaves undivided23
- 5 Underleaves deeply bilobed; lobes widely diverging (*Drepanolejeunea*, *Leptolejeunea*) 6
- 5 Underleaves shallowly bilobed; lobes not widely diverging12

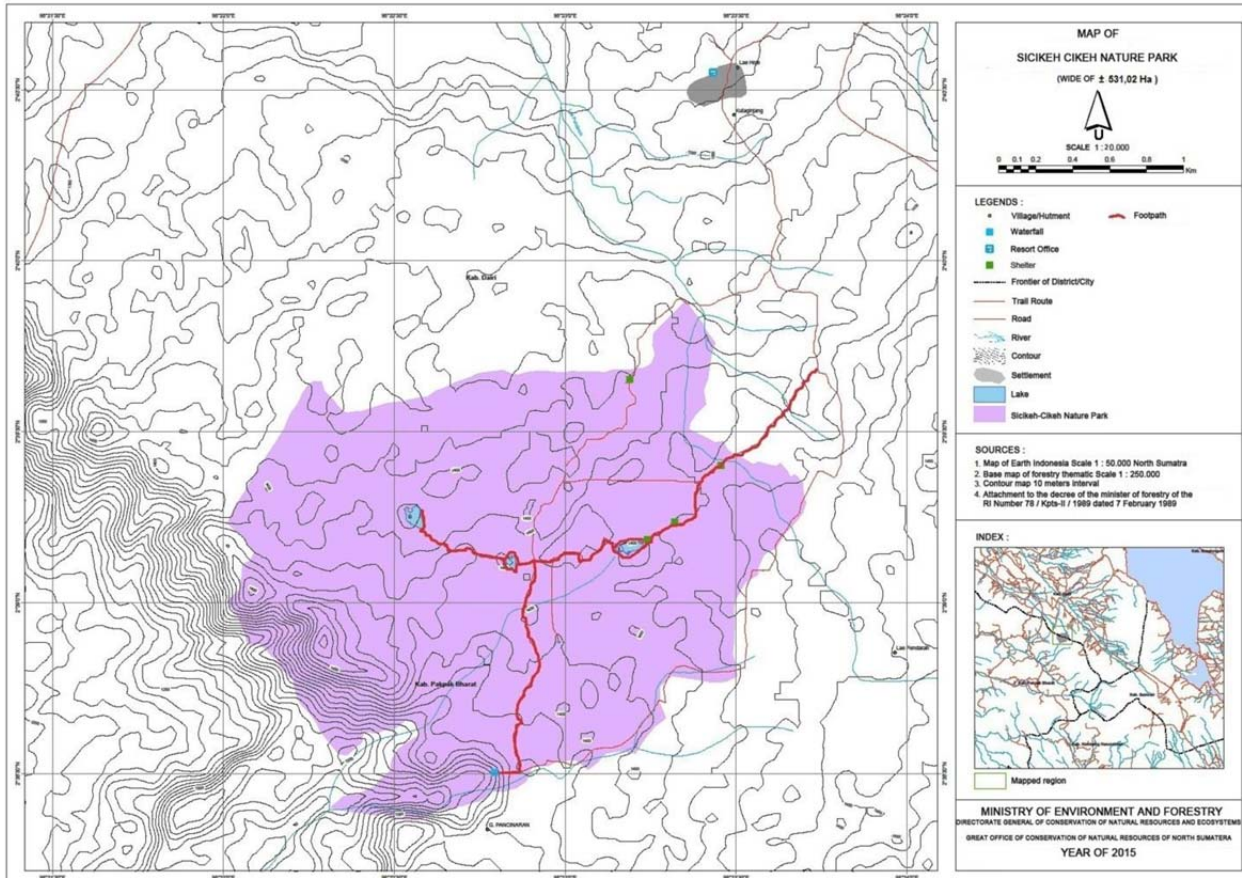


Fig. 1. Location of Sicike-cike Natural Park, North Sumatra Indonesia (Source: Great office of Conservation of Natural Resources of North Sumatra).

- 6 Margin of leaf lobes entire; leaf cells large with distinct trigones22. *Leptolejeunea foliicola*
- 6 Margin of leaf lobes toothed; leaf cells smaller with indistinct trigones (Drepanolejeunea) 7
- 7 Ocelli lacking or only 1–2 at the base 8
- 7 Ocelli numerous 10
- 8 Underleaf lobes 1 cell wide; leaf margin crenulate 12. *Drepanolejeunea ternatensis*
- 8 Underleaf lobes 2–3 cells wide; leaf margin toothed9
- 9 Leaves and underleaves obliquely spreading; underleaves bilobed to 1/2–2/3 of its length 15. *Drepanolejeunea vesiculosa*
- 9 Leaves and underleaves widely spreading; underleaves bilobed to almost its base 11. *Drepanolejeunea levicornua*
- 10 Leaf margin irregularly coarsely dentate; leaf-lobules 2/5–1/2 leaf-lobe length 10. *Drepanolejeunea fissicornua*
- 10 Leaf margin regularly and minutely dentate; leaf-lobules 1/3–2/5 leaf-lobe length 11
- 11 Leaf with small ocelli, about as large as neighboring cells 13. *Drepanolejeunea thwaitesiana*
- 11 Leaf with large ocelli, about 2x larger than neighboring cells 14. *Drepanolejeunea tricornua*
- 12 Leaf lobe cells usually coarse; hyaline papilla at the distal side of second tooth of leaf lobule (Cheilolejeunea)13
- 12 Leaf lobe cells usually smooth; hyaline papilla at the proximal side of first tooth of leaf lobule17
- 13 Underleaves very short bifid, 1/5–1/7 of its length 2. *Cheilolejeunea incisa*
- 13 Underleaves more deeply bifid, 1/3–1/2 of its length 14
- 14 Leaf-lobules 1/2–2/3 of lobe length, rectangular 5. *Cheilolejeunea trapezia*

- 14 Leaf-lobules less than 1/2 of lobe length, ovate 15
- 15 Underleaves large, 4–6 x stem width, imbricate 6. *Cheilolejeunea trifaria*
- 15 Underleaves smaller, 2–3 x stem width, distant16
- 16 Leaf cells trigones large; leaf-lobules about 1/3–1/2 of lobe length4. *Cheilolejeunea serpentina*
- 16 Leaf cells trigones minute or lacking; leaf-lobules about 1/3 of lobe length.....3. *Cheilolejeunea intertexta*
- 17 Leaves almost parallel to stem; leaf-lobules large, 1/2–3/4 of leaf lobe length27. *Metalejeunea cucullata*
- 17 Leaves obliquely to widely spreading; leaf-lobules smaller, 1/4–1/2 of leaf lobe length.....18
- 18 Underleaves undivided and bifid on single stem 17. *Lejeunea exilis*
- 18 All of underleaves bifid.....19
- 19 Underleaves large, 4–6 x stem width20
- 19 Underleaves smaller, 2–3 x stem width21
- 20 Underleaves wider than long, apex bifid to 1/4 20. *Lejeunea sordida*
- 20 Underleaves longer than wide, apex bifid to 2/518. *Lejeunea flava*
- 21 Leaf-lobules large, ca 1/2 of leaf lobe length16. *Lejeunea discreta*
- 21 Leaf-lobules smaller, less than 1/2 of leaf lobe length 22
- 22 Leaf-lobules ca 1/4 to 1/5 as long as the leaf lobe, or sometimes reduced; trigones indistinct 19. *Lejeunea obscura*
- 22 Leaf-lobules ca 1/3 as long as the leaf lobe, never reduced; trigones distinct 21. *Lejeunea tuberculosa*
- 23 Median cells of leaves longer than wide (Acrolejeunea & Thysananthus)24



- 23 Median cells of leaves almost isodiametric (*Lopholejeunea*) 26
 24 Margin of leaves and underleaves entire; underleaves orbicular to reniform.1. *Acrolejeunea pycnoclada*
 24 Margin of leaves and underleaves crenulate or toothed; underleaves spatulate (*Thysananthus*)25
 25 Upper part of leaves ventrad (curved in ventral direction), asymmetric 28. *Thysananthus convolutus*
 25 Upper part of leaves not ventrad, symmetric
 29. *Thysananthus spathulistipus*
 26 Leaf lobule attached to the leaf lobe by only a single cell.....27
 26 Leaf lobule attached to the leaf lobe across several cells.....28
 27 Leaf lobule constricted at the apex23. *Lopholejeunea euplopha*
 27 Leaf lobule strongly constricted at the middle
 24. *Lopholejeunea herzogiana*
 28 Stem scarcely branched; apex of leaves and underleaves plane25. *Lopholejeunea subfusca*
 28 Stem usually profusely branched; apex of leaves and underleaves recurved 26. *Lopholejeunea zollingeri*

1. *Acrolejeunea pycnoclada* (Taylor) Schiffl., Hepat. (Engl.-Prantl), 1(3): 128.1893. = *Ptychanthus pycnocladius* Taylor, London J. Bot. 5: 385.1846.

The species is characterized by convolute leaves when dry, margin of leaves and underleaves entire; leaf-lobules with 2–3 teeth and the first tooth situated at the extreme end of the free margin; underleaves orbicular to reniform.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epixylous, September 17th, 2016, alt. 1423–1451 m, *E. Siregar* 2474, 2554.

Distribution: Pantropical in *Distribution*, Australia, India, Indonesia (Java, Sumatra, West Irian), Papua New Guinea, Peninsular Malaysia, Philippines (Gradstein *et al.*, 2002; Sass-Gyarmati, 2003; Haerida *et al.*, 2010).

2. *Cheilolejeunea incisa* (Gottsche) R.M.Schust. & Kachroo, J. Linn. Soc. Bot. 56: 509. 1960. *Lejeunea incisa* Gottsche, Syn. Hepat. 360. 1845. *Pycnolejeunea incisa* (Gottsche) Steph., Sp. Hepat. 5: 624. 1914.

The species is distinctive in having underleaves with very short bifid apex, $\frac{1}{5}$ to $\frac{1}{7}$ of underleaf.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, September 17th 2016, alt. 1387 m, *E. Siregar* 2542.

Distribution: Australia, Indonesia (Java, Sumatra), Papua New Guinea (Thiers, 1992).

3. *Cheilolejeunea intertexta* (Lindenb.) Steph., Bull. Herb. Boiss. 5: 79. 1897. *Lejeunea intertexta* Lindenb. in Gottsche, Lindenb. & Nees, Syn. Hep. 379. 1845.

The species is characterized by rounded leaf apex; minute or lacking trigone; small leaf-lobules *ca* $\frac{1}{3}$ lobe length.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, July 30th 2016, alt. 1401 m, *E. Siregar* 2088.

Distribution: Brazil, Caroline Is., China, Ghana, India, Indonesia (Java, Sumatra), Madagascar, Philippines, Singapore, Sri Lanka, Thailand (Zhu *et al.*, 2002; Bastos, 2012).

4. *Cheilolejeunea serpentina* (Mitt.) Mizut., J. Hattori Bot. Lab. 26: 11. 1963. *Lejeunea serpentina* Mitt., J. Proc. Linn. Soc., Bot. 5: 112. 1861.

The species is characterized by large trigone; ovate leaf-lobules, $\frac{1}{3}$ – $\frac{1}{2}$ lobe length; underleaves 2–3 times as wide as stem.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epixylous, September 30th 2016, alt. 1419 m, *E. Siregar* 2207.

Distribution: Paleotropic (Zhu *et al.*, 2002).

5. *Cheilolejeunea trapezia* (Nees) Kachroo & R.M.Schust., J. Linn. Soc., Bot. 56 (368): 509. 1961. *Jungermannia trapezia* Nees, Enum. Pl. Crypt. Jav. 41. 1830.

The species is characterized by the the large oblong to rectangular leaf-lobule with wide apical portion (5–13 cells wide); ventral merophyte of stem 4 cells wide.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, July 30th, 2016, alt. 1398–1405 m *E. Siregar* 2104, 2376; September 16th 2016, alt. 1405 m *E. Siregar* 2379.

Distribution: Widespread in tropical and subtropical regions of Asia and Oceania (Zhu and So, 2001).

6. *Cheilolejeunea trifaria* (Reinw., Blume et Nees) Mizut., J. Hattori Bot. Lab. 27: 132. 1964. *Jungermannia trifaria* Reinw., Blume & Nees, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12 (1): 226. 1824.

The species is characterized by large and imbricate underleaves, 4–6 times of stem width, wider than long; apex of lobe obtuse to rounded, incurved; trigones large, triangular.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, September 30th 2016, alt. 1398 m *E. Siregar* 2103; 1419 m *E. Siregar* 2194.

Distribution: China, India, Indonesia (Java, Sumatra), Pantropics (Zhu and So, 2001; Gradstein, 2011).

7. *Cololejeunea angustiflora* (Steph.) Mizut., J. Hattori Bot. Lab. 28: 113. 1965. *Leptocolea angustiflora* Steph., Sp. Hepat. (Stephani) 5: 848. 1916.

The species is characterized by oblong to lanceolate leaf; cell walls colorless, with small trigones; leaf-lobule wide spreading, ovate, free margin inflated; stylus consisting of one cell long.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epiphyllous, September 16th 2016, alt. 1407 m, *E. Siregar* 2430.

Distribution: China, Fiji Islands, Indonesia (Java, Sumatra), Malaysia, New Caledonia, Papua New Guinea, Philippines, Vietnam (Pócs, 2012; Zhu and So, 2001).



8. *Cololejeunea stephanii* Schiffn. ex Benedix, Feddes Repert. Spec. Nov. Regni Veg. Beih. 134: 40. 1953.

The species is distinctive in having leaf margin bordered by hyaline cells; first tooth of leaf-lobule falcate; leaf-lobe with long vitta, longer than leaf-lobules, clearly visible in ventral view; stylus consist of 3 cells long.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epiphyllous, September 16th 2016, alt. 1407m, *E. Siregar* 2430.

Distribution: China, Indonesia (Java, Sumatra: based on recent study), Japan, Malaysia, Philippines (Mizutani, 1961; Zhu and So, 2001).

9. *Colura acroloba* (Mont. ex Steph.) Jovet-Ast., Rev. Bryol. Lichenol. 22: 297. 1953. *Lejeunea acroloba* Prantl, Hedwigia 29: xiv. 1980.

The species is distinctive in having inflated sac at the leaf apex; base of underleaves with numerous rhizoid; underleaves deeply bilobed, lobes linear-lanceolate.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epiphyllous, July 30th 2016, alt. 1393 m, *E. Siregar* 2241.

Distribution: Australia, Cambodia, China, India, Indonesia (Java, Sumatra), Malaysia, New Caledonia, New Guinea, Philippine, Samoa, Solomon Is., Sri Lanka, Thailand, Vietnam (Zhu and So, 2001).

10. *Drepanolejeunea fissicornua* Steph., Spec. Hepat. 5: 344. 1913. Mizutani, J. Hattori. Bot. Lab. 68: 375-377. 1990.

The species is characterized by coarsely and irregularly dentate at dorsal margin of leaf; leaf-lobules large $ca \frac{2}{3}$ to $\frac{1}{2}$ as long as the leaf-lobe; underleaves distant, widely spreading, lobe consist of 6-8 cells long with 2 cells wide at the base and 2-3 uniseriate cells at upper portion.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epiphyllous, September 30th 2016, alt. 1401 m, *E. Siregar* 2102.

Distribution: Indonesia (Java, Sumatra), Peninsular Malaysia, (Mizutani, 1990; Pócs *et al.*, 2013).

11. *Drepanolejeunea levicornua* Steph., Sp. Hepat. 5: 347. 1913.

The species is distinctive in lacking ocelli at the middle of leaf-lobe; margin of leaf-lobe dentate; underleaves with numerous rhizoids at the base, bilobed to the base of underleaf, lobes lanceolate, horizontally spreading, 5-6 cells long.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epiphyllous, September 17th 2016, alt. 1423-1451 m, *E. Siregar* 2476, 2501, 2521, 2557, 3407.

Distribution: China, Indonesia (Borneo, Java, Seram, Celebes, Sumatra-based on recent study), Malaysia, New Guinea (Zhu and So, 2001).

12. *Drepanolejeunea ternatensis* (Gottsche) Schiffn., Hepat. (Engl.-Prantl): 126. 1893. *Lejeunea ternatensis* Gottsche in Gottsche, Lindenb. & Ness, Syn. Hepat. 346. 1845.

The species is characterized by obliquely ovate-lanceolate leaf-lobe with incurved apex, margin usually crenulate; leaf-lobule large, oblong-ovate, about $\frac{1}{2}$ to $\frac{3}{4}$ as long as lobe; underleaves distant, bifid, lobe consist of 4 cells long, 1 cell wide (except at the base 2 cells wide).

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, July 30th 2016, alt. 1401 m, *E. Siregar* 2087, 2088, 2098, 2258.

Distribution: Australia, Caroline Is., China, Fiji, India, Indonesia (Java, Moluccas, Seram, Sumatra-based on recent study), Japan, Malaysia, Micronesia, Papua New Guinea, Philippines, Samoa, Seychelles, Sri Lanka (Zhu and So, 2001).

13. *Drepanolejeunea thwaitesiana* (Mitt.) Steph., Sp. Hepat. 5: 350. 1913. *Lejeunea thwaitesiana* Mitt., J. Proc. Linn. Soc., Bot. 5 (18): 117. 1861.

The species is characterized by obliquely ovate leaf-lobe, with numerous scattered ocelli; margin dentate, dorsal margin arched, becoming narrow towards base; underleaves distant, widely spreading, lobe consist of 5-7 cells long with 2 cells wide at the base and composed of 2-4 uniseriate cells at the upper portion.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epiphyllous, July 30th 2016, alt. 1422 m, *E. Siregar* 2182; July 31th 2106, alt. 1401 m, *E. Siregar* 2501, 2528; September 16th 2016, alt. 1387, *E. Siregar* 2970.

Distribution: Cambodia, China, India, Indonesia (Borneo, Java, Seram, Sumatra-based on recent study), Sri Lanka, Thailand, Peninsular Malaysia, New Guinea (Mizutani, 1990; Zhu and So, 2001; Gradstein, 2011).

14. *Drepanolejeunea tricornua* Herzog, Ann. Bryol. 9: 124. 1936.

The species is characterized by the large ocelli, about 2 times as large as the neighboring cells; leaf-lobule $\frac{1}{3}$ lobe length; underleaves distant, widely spreading, lobe consist of 6-8 cells long with 2 cells wide at the base and composed of 2-3 uniseriate cells at the upper portion.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epiphyllous, July 31th 2016, alt. 1422 m, *E. Siregar* 2182; September 17th 2016, alt. 1408 m, *E. Siregar* 2506.

Distribution: Indonesia (Java, Seram, Sumatra-based on recent study), Papua New Guinea, Peninsular Malaysia, Vietnam (Mizutani, 1990; Pócs *et al.*, 2013).

Note: *Drepanolejeunea tricornua* is closely related to *D. thwaitesiana* but can be separated by the large ocelli ca 2 times as large as the neighboring cells in *D. tricornua*.



15. *Drepanolejeunea vesiculosa* (Mitt.) Steph., Sp. Hepat. 5: 356. 1913. *Lejeunea vesiculosa* Mitt., J. Proc. Linn. Soc. Bot. 5:116. 1861.

The species is characterized by weakly dentate to entire margin of leaf-lobe, cells of dorsal side of leaf lobe papillose, absence of ocelli; underleaves distant, bilobed to $\frac{1}{2}$ – $\frac{2}{3}$ of its length, lobes 3–5 cells long, 2 cells wide.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epiphyllous, July 30th 2016, alt. 1401 m, *E. Siregar* 2087.

Distribution: Africa, Australia, China, India, Indonesia (Java, Sumatra), Japan, New Caledonia, Philippines, Samoa, Singapore, Sri Lanka, Tahiti, Taiwan, Vietnam (Zhu and So, 2001).

16. *Lejeunea discreta* Lindenb. in Gottsche *et al.*, Syn. Hepat.: 361. 1845.

The species is recognized by the large leaf-lobules *ca* $\frac{2}{5}$ – $\frac{1}{2}$ leaf-lobe length, free margin strongly incurved, leaf cells with well-developed trigones; underleaves contiguous, large *ca* 4 times as large as stem.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, July 30th 2016, alt. 1401 m, *E. Siregar* 2088.

Distribution: widespread in southeast Asia, from India to Papua New Guinea; also in northern Australia (Queensland), and New Caledonia (Lee, 2013).

17. *Lejeunea exilis* (Reinw., Blume et Nees) Grolle, J. Hattori Bot. Lab. 46: 353. 1979. *Jungermannia exilis* Reinw., Blume & Nees, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12: 227. 1825.

The species can be easily recognized from the other species of *Lejeunea* by its small size plants (less than 0.7 mm wide), underleaves dimorphic (bifid and undivided) on single shoot.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, July 30th 2016, alt. 1401 m, *E. Siregar* 2087.

Distribution: Tropical Asia, Australia, New Caledonia, and the western Pacific (Lee, 2013).

18. *Lejeunea flava* (Swartz) Nees, Naturgesch. Eur. Leberm. 3: 277. 1838. *Jungermannia flava* Swartz, Prodr. 144. 1788.

The species is recognized by profusely and irregularly branched, sometimes loosely bipinnately branched; leaves imbricate, leaf-lobes ovate, with small trigone; leaf-lobules small, *ca* $\frac{1}{4}$ of leaf-lobe length, apex obliquely truncate; underleaves loosely imbricate, occasionally distant, large *ca* 4 times as wide as the stem, longer than wide.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, July 30th 2016, alt. 1401 m, *E. Siregar* 2088; September 17th 2016, alt. 1398–1408 m, *E. Siregar* 2102, 2218, 2512.

Distribution: A very common, pantropical species.

Note: *Lejeunea flava* is closely related to *L.*

discreta in the large underleaves, but the latter has larger leaf-lobules with incurved free margins.

19. *Lejeunea obscura* Mitt., J. Proc. Linn. Soc., Bot. 5: 112. 1861.

The species is recognized by strongly reduced leaf-lobule, although sometimes the leaf-lobule is well developed, up to $\frac{1}{4}$ leaf-lobe length; underleaves distant, 2–3 times as wide as the stem, bilobed to $\frac{1}{2}$ underleaf length.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous and epiphyllous, July 30th 2016, alt. 1398, *E. Siregar* 2104; September 17th 2016, alt. 1423 m, *E. Siregar* 2476, 2513.

Distribution: China, India, Indonesia (Java, Sumatra-based on recent study) Nepal, Sri Lanka (Zhu and So, 2001).

20. *Lejeunea sordida* (Nees) Nees, Naturgesch. Eur. Leberm. 3: 278. 1838.

Jungermannia sordida Nees, Enum. Pl. Crypt. Jav.: 41. 1830.

The species is recognized by the large (5–6 times as wide as the stem) underleaves, reniform, shallowly bifid ($\frac{1}{4}$ to $\frac{1}{3}$ of lobe length), leaf-lobules small, cells of leaf-lobes with distinct trigones.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous and epiphyllous, July 30th 2016, alt. 1422 m, *E. Siregar* 2182; September 17th 2016, alt. 1387–1407 m, *E. Siregar* 2430, 2544, 2970.

Distribution: Australia, Caroline Is., China, Fiji, India, Indonesia (Java, Sumatra), Japan, Micronesia, New Caledonia, Papua New Guinea, Peninsular Malaysia, Philippines, Samoa, Solomon Is., Thailand (Lee *et al.*, 2010; Gradstein, 2011).

21. *Lejeunea tuberculosa* Steph., Sp. Hepat. 5: 790. 1915.

The species is recognized by the minute size of plant (0.5–0.8 mm wide); large trigones; small and ovate lobule (*ca* $\frac{1}{3}$ as long as lobe), with slightly incurved free lateral margin, slightly crenulate keel; underleaves small and suborbicular, *ca* 2–3 times as wide as the stem, apex bilobed to $\frac{1}{2}$ underleaf length.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, date: September 17th 2016 alt. 1408 m, *E. Siregar* 2513.

Distribution: Africa, Bhutan, China, India, Indonesia (Java, Sumatra), Nepal, Philippines (Zu & So, 2001; Verma & Srivastava, 2011).

22. *Leptolejeunea foliicola* Steph. Hedwigia 35 (3): 106. 1896.

The species is recognized by deeply bilobed underleaves, with linear-lanceolate lobes, 5–7 cells long (2 cells wide at the base and composed of 5–7 uniseriate cells at the upper portion); underleaves with basal disc, margin entire.



Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, epiphyllous, September 17th 2016, alt. 1407 m, *E. Siregar* 2421, 2430, 2575.

Distribution: China, Japan, India, Indonesia (Java, Sumatra-based on recent study) (Mizutani, 1960; Zhu and So, 2001).

23. *Lopholejeunea eulopha* (Taylor) Schiffn., Hepat. (Engl.-Prantl): 129. 1893. *Lejeunea eulopha* Taylor, London J. Bot. 5: 391. 1846.

The species can be easily recognized by the the large, reniform underleaves 4–6 times stem width, lobule apex attached to the leaf across only one cell.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, July 30th 2016, alt. 1392 m, *E. Siregar* 2263; September 17th 2016, alt. 1408 m, *E. Siregar* 2483.

Distribution: Australia, tropical Africa, tropical America, China, India, Indonesia, Japan, Oceanic, Philippines, Pasific, Solomon Is., Sri Lanka, (Zhu & Gradstein, 2005; Haerida *et al.*, 2010).

24. *Lopholejeunea herzogiana* Verd., Recueil, Trav. Bot. Neerl. 30: 217. 1933.

The species is easily recognized by the leaf lobule conspicuously constricted in the middle and with strongly involuted free margin, lobule apex connected to the leaf lobe by one cell; large and reniform underleaf; perianth with widely winged, obovate, toothed.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, September 17th 2016, alt. 1452 m, *E. Siregar* 2556.

Distribution: Indonesia (Java, Sumatra-based on recent study, West Irian), New Caledonia, Papua New Guinea, Peninsular Malaysia (Haerida *et al.*, 2010).

25. *Lopholejeunea subfusca* (Nees) Schiffn., Bot. Jahrb. Syst. 23: 593. 1897. *Jungermannia subfusca* Nees, Enum. Pl. Crypt. Jav. 1: 36. 1830.

The species is easily recognized by the truncate leaf-lobule apex, connected to the leaf-lobe across 2-4 cells, leaf-lobule about $\frac{1}{4}$ – $\frac{1}{3}$ of lobe length; leaves flat with rounded apex; underleaves distant, orbicular, small (2–3 times as wide as stem).

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous and epixylos, September 16th 2016, alt. 1380–1401 m, *E. Siregar* 2373, 2391, 2400; date: September 17th 2016, alt. 1387 m, *E. Siregar* 2544.

Distribution: Pantropical; very common in the following Asian countries: Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Japan, Malaysia, Nepal, Papua New Guinea, Philippines, Singapore, Sri Lanka, Thailand, Vietnam (Zhu & Gradstein, 2005).

26. *Lopholejeunea zollingeri* (Steph.) Schiffn., Consp. Hepat. Arch. Ind. 296. 1898. *Lejeunea zollingeri* Steph., Hedwigia 29: 14. 1890.

The species is easily recognized by broadly

orbicular leaf-lobe with recurved apex; leaf-lobule large, apex connected to the leaf-lobe across 3–4 cells; underleaves large, reniform.

Specimen examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, September 16th 2016, alt. 1405 m, *E. Siregar* 2383.

Distribution: China, Fiji, Indonesia (Java, Borneo, Celebes, Sumatra), Japan, Papua New Guinea, Peninsular Malaysia, Philippines, Sri Lanka (Haerida *et al.*, 2010).

27. *Metalejeunea cucullata* (Reinw. *et al.*) Grolle, Bryophyt. Biblioth. 48: 100, 1995. *Jungermannia cucullata* Reinw., Blume et Nees, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12 (1): 227. 1825.

The species is easily recognized by the very large leaf-lobules on main stem, $\frac{1}{2}$ – $\frac{3}{4}$ of lobe length; plant small, less than 0.5 mm wide; leaves suberect or parallel to the stem.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, and epiphyllous, July 30th 2016, alt. 1392 m, *E. Siregar* 2225; July 31th 2016, alt. 1392 m, *E. Siregar* 2232, 2303; September 16th 2016, 1410 m, *E. Siregar* 2381, 2417.

Distribution: common in Pantropic.

28. *Thysananthus convolutus* Lindenb. in Gottsche *et al.*, Syn. Hepat. 288. 1845; Haerida *et al.*, Gard. Bull. Sing. 62 (1): 91-92. 2010.

The species is easily recognized by asymmetric leaf-lobe with upper part ventrad (curved in ventral direction) and recurved, margin toothed or entire; leaves closely imbricate, usually strongly convolute when dry; sub-oblong underleaves, with toothed margins and recurved apex.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, July 30th 2016, alt. 1401 m, *E. Siregar* 2095, 2192; September 17th 2016, alt. 1420 m, *E. Siregar* 2581.

Distribution: Indonesia (Borneo, Celebes, Java, Moluccas, Sumatra), Papua New Guinea, Peninsular Malaysia, Philippines, Solomon Is. (Gradstein *et al.*, 2002).

29. *Thysananthus spathulistipus* (Reinw. *et al.*) Lindenb. in Gottsche *et al.*, Syn Hepat. 287. 1845. Syn. Hepat. 287. 1845. *Jungermannia spathulistipa* Reinw. *et al.*, Acta Phys. Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12: 212. 1824.

The species is easily recognized by toothed margins of leaves and underleaves; symmetrical leaves; leaf-lobule ovate with truncate apex, underleaves spathulate.

Specimens examined: Sumatra: North Sumatra: Sicike-cike Natural Park, corticolous, epixylos and epiphyllous, July 30th 2016, alt. 1401 m, *E. Siregar* 2088; July 31th 2016, alt. 1407 m, *E. Siregar* 2131; September 16th 2016, *E. Siregar* 2204; September 17th 2016, alt. 1419–1452 m, *E. Siregar* 2308, 2460, 2564.



Distribution: Australia, India, Indonesia (Bali, Borneo, Celebes, Java, Moluccas, Sumatra, Sumbawa, West Irian), Papua New Guinea, Peninsular Malaysia, Sri Lanka, Solomon Is., Thailand, Tropical Africa (Haerida *et al.*, 2010).

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