Species of Liverworts Family Plagiochilaceae of Mount Lubuk Raya North Sumatera Indonesia

E S Siregar*, N Pasaribu and Fitriana

Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, Indonesia. Jl. Bioteknologi No.1 Kampus USU Padang Bulan Medan, Indonesia, Telp.061-8223564

*E-mail: ettisartina@yahoo.com

Abstract. The species diversity of Plagiochilaceae in Sumatera, especially North Sumatera has not been widely reported. This study aims to know the species richness of Plagiochilaceae at Mount Lubuk Raya, North Sumatera. The study was conducted from July until December 2017. Sample was collected along the hiking trails in the study site using the explorative survey method. Eighteen species of Plagiochilaceae have been encountered belonging to two genera: Pedinophyllum, and Plagiochila. Among the species, Plagiochila nobilis is a new record to the liverworts flora of Sumatera. The species of Plagiochilaceae were found as epiphyte on the tree trunk, on the decaying wood and twigs. The common species found in the study sites was Plagiochila arbuscula, while the uncommon species were Pedinophyllum interruptum, Plagiochila obtusa, Plagiochila schiopila and Plagiochila teysmannii.

1. Introduction

There are about 18,000 species of bryophytes around the world, and placed them as the second largest group after flowering plants [1]. Bryophytes are divided into three groups namely hornworts, mosses and liverworts [2]. Liverworts are divided into two groups, thallose liverworts and leafy liverworts. One of the leafy liverwort family which is found in the forest is Plagiochilaceae [3].

Plagiochilaceae is one of the leafy liverworts family that has a wide distribution in the world. It is consists of eight genera, and 500 species [4]. The specific characters of the family are: 1) plant often with a rhizome-like creeping base, 2) leaves succous, bases decurrent, and margin usually toothed with recurved dorsal, 3) underleaves usually small, sometimes vestigial, or absent [5].

Information of Plagiochilaceae in Indonesia is still rarely reported until now. Previous study on Plagiochilaceae has been reported from few areas including Mount Ungaran Central Java [6], Mount Patuha West Java [7], the lowland forest Toro Sulawesi, lowland forest Bariri Sulawesi, and the upper mountains forest Rorekatimbu Sulawesi [8]. However, data and information related to Plagiochilaceae in North Sumatra is still lacking. Plagiochilaceae w ich reported from North Sumatra are: 21 species at Sibayak Forest [9]; 1 species in Lau Kawar Regency of Karo [10]; 12 species at the Tourist Park Forest Deleng Lancuk [11]. The collection and information about leafy liverworts family Plagiochilaceae at Mount Lubuk Raya has never been reported until now. So, it is necessary to study the species of Plagiochilaceae at Mount Lubuk Raya North Sumatra to inventory their species richness.
2. Methods

2.1 Study Sites

The study was conducted at Mount Lubuk Raya, South Tapanuli, North Sumatera. The area is about 3050 ha, at 1.060-1.892 m above sea level (asl), the annual rainfall is about 2.387 mm/year, moisture is ranges from 67-77 %.

2.2. Field Work

Exploration was conducted in July through the accessible track of Mount Lubuk Raya. Each species found was collected, and recorded its distinctive characters. The samples were dissected from substrate used knife and inserted in to the paper envelope and recorded some information such as collection date, collector, substrate, elevation, coordinate, humidity etc.

2.3. Classification and Identification

The specimens collected were classified and identified based on morphological characters, using literatures such as: Inoue [4], So [12, 13], Gradstein [14], and other publications of Asian Plagiochilaceae. Some important morphological characters including plant width, lateral leaves (shape, base, saccus, margin, apex, trigon cell), underleaves, and perianth if present were observed. under a binocular microscope with standard measurement. The collected specimens are deposited at the Herbarium Medanense (MEDA), Universitas Sumatera Utara.

3. Results and Discussion

During the taxonomic evaluation of Plagiochilaceae, 18 species has been encountered, that belong to two genera: Pedinophyllum (1 species) and Plagiochila (17 species). One species, Plagiochila nobilis is identified as new record for Sumatera.

P. nobilis is the numerous genera found in the study site compared to Pedinophyllum. In terms of number of species, Plagiochila is more speciose than Pedinophyllum [4]. In this study, the most commonly found species is Plagiochila arbuscula consisted of 56 samples. Plagiochila arbuscula has a wide distribution throughout Indonesia (Java, Sumatra, Kalimantan), China, Japan, Taiwan, Thailand, Philippines, Malaya, Papua New Guinea to Solomon Islands [4]. The species with the smallest number of sample are Pedinophyllum interruptum, Plagiochila obtusa, Plagiochila sciophila and Plagiochila teysmannii which consisted of 1 sample.

The total number of species obtained in this study is relatively similar to the number reported from Sibayak Forest, North Sumatra [14], where they collected 18 species of genus Plagiochila. These two areas both are categorized as a lower to upper montane rain forests. However, the total number of species found in this study is higher than the number of species recorded from Simancik Forest I, North Sumatera, reported 4 species of genus Plagiochila [15]. This area is a lowland rain forest in Sumatera, where liverworts species number are commonly lesser than lower montane forest. The richness of liverworts species is related to the spread and increased of elevation [2]. Plagiochilaceae is commonly found in lower montane forests and very rarely found in upper mountain forests [8].

Based on the parameters measurement at Mount Lubuk Raya, avarage temperature, light intensity, and humidity were 20-25,20 C, 20.9-85 lux, 69-85%, respectively. The physico-chemical factor in the area was assumed fit for liverwort growing. The diversity and abundance of liverworts species is influenced by micro environments such as air temperature, light intensity and air humidity [17]. Bryophyte generally can grow optimally at 10-30 ° C and 70-98% humidity [18].

Species of Plagiochilaceae were growing epiphytically on various substrate such as tree trunks, twigs and decaying wood. Most plants were dominantly found on the tree trunks. From the study, it is observed that liverwort is generally inhabit lower tree trunk which has high humidity [8].
List of Plagiochilaceae (with description of new record species for Sumatra) found in Mount Lubuk Raya arranged alphabetically:

1. *Pedinophyllum interruptum* (Nees) Kaal.- on tree trunk, at 1.106 m asl altitudinal, Fitriana 109.

2. *Plagiochila arbuscula* (Brid. ex Lehm. et Lindenberg.) Lindenberg.- on the tree trunks, at 865 - 1.280 m asl altitudinal. Fitriana 20, 32, 45, 46, 52, 64, 66, 75, 79, 80, 81, 82, 86, 87, 90, 97, 98, 100, 102, 104, 106, 115, 116, 117, 120, 122, 124, 125, 127, 129, 132, 133, 136, 137, 138, 139, 142, 144, 146, 147, 148, 149, 185, 194, 195, 199, 204, 206, 207, 208, 209, 211, 213, 215, 219, 226

3. *Plagiochila bantamensis* (Reinw. et al.) Dum.- on the tree trunks and twigs, at 865-1568 m asl altitudinal. Fitriana 11, 15, 25, 30, 31, 34, 57, 62, 63, 69, 72, 73, 74, 93, 110, 114, 135, 148, 150.

4. *Plagiochila clavato-saccata* Steph.- on the tree trunks at 865–1106 m asl. Fitriana 04, 05, 23, 24, 40, 41, 42, 71, 77, 94, 95, 185.

5. *Plagiochila dendroides* (Nees) Lindenbg.- on the tree trunks, at 974–1280 m asl. Fitriana 56, 58, 60, 67, 121.

6. *Plagiochila frondescens* (Nees) Lindenbg.- on the tree trunks, at 974 m asl. Fitriana 61, 22.

7. *Plagiochila javanica* (Swartz) Dum.- on the tree trunks at 974 m asl. Fitriana 09, 14, 51, 59, 65, 75, 78, 85, 99, 130, 181, 197, 198, 202, 216, 218, 222.

8. *Plagiochila junghuhniana* S. Lac.- on the tree trunks at 829-1568 m asl. Fitriana 33, 39, 43, 44, 83, 88, 89, 152, 164, 168, 200, 203.

9. *Plagiochila nobilis* Gott.
   Plant green to yellowish to brownish in the dry specimen, about 5-8 mm wide, branches few, if present always lateral-intercalary, leaves rare, lobes obovate, 4-6 mm long, 1.9-2.6 mm wide; dorsal margin with 2 teeth, 3-4 cells long, teeth present on whole ventral margin, 2-6 cells long; base dilated, apex rounded with 4 teeth, 4-6 cell long; leaf cells with trigon small, nodulose or triangular cuticle smooth, underleaves vestigial.
   Ecology: found on the tree trunk at 974-1162 m asl
   Distribution: The Philippine, Indonesia (Java, Sumatra: new record) [4]
   Specimen examined: Fitriana 63, 70, 143

Figure 1. *Plagiochila nobilis* a. Habit b. Lateral leaf c. Leaf cells
10. *Plagiochila obtusa* Lindenb.- on the tree trunk, at 1162 m asl. Fitriana 140

11. *Plagiochila peculiaris* Schiffn.- on the tree trunk, at 1568 m asl. Fitriana 135, 155, 210, 227.

12. *Plagiochila salacensis* Gott.- on the tree trunks and decaying wood, at 778-1568 m asl. Fitriana 01, 02, 03, 06, 10, 13, 16, 17 18, 19, 21, 29, 33, 35, 36, 89, 101, 103, 151.

13. *Plagiochila sandei* Dozy.- on the tree trunks and twigs, at 974-1280 m asl. Fitriana 50, 55, 123, 145.

14. *Plagiochila sciophila* Nees.- on the tree trunks, at 829 m asl. Fitriana 38, 96.

15. *Plagiochila singularis* Schiffn.- on the tree trunk, at 829 m asl. Fitriana 37, 68, 84, 113, 154.

16. *Plagiochila sumatrana* Schiffn.- on the tree trunks, at 865-939 m asl. Fitriana 08, 26, 48, 49.

17. *Plagiochila teysmannii* S. Lac.- on the tree trunk, at 865-939 m asl. Fitriana 22.

18. *Plagiochila ungarangana* S. Lac.- on the tree trunks, at 865 m asl. Fitriana 27, 28.

**4. Conclusions**

There are 18 species of *Plagiochilaceae*, which consist of two genera: *Pedinophyllum* (1 species) and *Plagiochila* (17 species). One species is known as new record for Sumatra, namely *Plagiochila nobilis*. The most common species found in the study is *Plagiochila arbuscula*, 56 samples. The uncommon species found in the area are *Pedinophyllum interruptum*, *Plagiochila obtusa*, *Plagiochila sciophila* and *Plagiochila teysmannii*, one sample for each species.

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**References**

[1] Tan BC and Ho BC 2008 *A Guide to The Mosses of Singapore* (Singapore: National Library Board)
[2] Gradstein SR, Keseler M, Muncheberg MH, Bos MM and Sporn SG 2009 *36 171*
[3] Hasan M, Ariyanti NS, 2004. *Mengenal Bryophyta (Lumut) Taman Nasional Gunung Gede Pangrango*. Cibodas. Balai Taman Nasional Gunung Gede Pangrango.
[4] Inoue H, 1984. *The Genus Plagiochila (Dum.) Dum. in Southeast Asia* (Tokyo: Academia Scientific Book INC)
[5] Gradstein SR 2011 *Guide to the Liverworts and Hornworts of Java* (Bogor: Seameo Biotrop)
[6] Sulistyowati DA, PerwatiLK and Wiryani E 2014 *Bioma* 16 26
[7] Gradstein SR, Kien-Thai Y and Suleiman M 2010 *Reinwardtia* 13 107
[8] Gradstein SR and Culmsee H 2010 *Tropical Bryology* 31 95
[9] Siregar ES, 2015. *The liverworts (Marchantyophyta) of Mount Sibayak North Sumatra* (Bogor: Institut Pertanian Bogor)
[10] Pasaribu N, 2013. Introduction Studies of Bryophyte in Lau Kawar, Regency of Karo. ISBN 978-602-98559-1-3. *Prosidng Semirata FMIPA*; Lampung, 10-12 May 2013. University of Lampung.
[11] Firina E N, 2015. *Jenis-Jenis Lumut Hati Berdaun Famili Plagiochilaceae di Taman Wisata Alam Deleng Lancut Kabupaten Karo Sumatera Utara* (Medan: Universitas Sumatera Utara)
[12] So ML 2001 *Plagiochila* (*Hepaticae, Plagiochilaceae*) in China *Systematic Botany Monographs* 60
[13] So ML 2010 *Plagiochila* sect. *Plagiochila* (*Hepaticae*) in SE Asia and Melanesia, with descriptions of two new species
[14] Siregar ES, Ariyanti NS and Tjitrosoedirdjo SS 2018 *IOP Conf. Ser.: Earth Environ. Sci.* 130 012017
[15] Pasaribu N, Siregar ES and Rahmi W 2018 *IOP Conf. Ser.: Earth Environ. Sci.* 130 012051
[16] Gradstein SR, Nadkarni NM, Kromer T, Holz I and Noske N 2003 Selbyana 24 105
[17] Vanderpoorten A and Engeles P 2002 *Journal Ecography* 25 513
[18] Uno GE, Storey R, and Moore R 2001 *Principles of Botany* (New York: Mc.Graw Hill)