



A Preliminary Study of Bryophytes in Enggano Island, Bengkulu, Indonesia

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Abstract

Enggano Island is one of the outer islands that belongs to the Province of Bengkulu. Furthermore, there is very limited information about the diversity of bryophyte from Sumatera, especially in lowland forest, Enggano Island. The aim of this research was to provide the initial information related to the diversity of bryophytes in Enggano. The research was conducted in six forests i.e. primary, secondary and degraded forests. The results showed that 32 number of collection from 14 families, 21 genera, and 32 species were identified. Leceuneaceae was common family for liverworts while the mosses family was dominated by Hypnaceae. None of the hornworts were found in this study. Some species identified (*Taxyphyllum* sp., *Vesicularia* sp., *Riccardia* sp., and *Thuidium* sp.) have the potential benefit and biological activity. Two genera were new records to Sumatra, *Gongylanthus*, and *Symphyogyna*. Moreover, *Gongylanthus* sp. and *Symphyogyna* sp. have important records related to the habitat.

How to Cite

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INTRODUCTION

Enggano Island is one of the outer islands in Indonesia with about 39.586.74 ha of flat area and 126.71 km of long coastline. Enggano Island is located in the Indian Ocean, North Bengkulu District, Bengkulu Province, Sumatra, Indonesia, between 102.05° – 102.25° E and 5.17° – 5.31° N (Bapedalda, 2005). About 36.32% area of Enggano Island is the forest. It has six conservation area (8.736,57 ha/ 22.08 %), these are nature reserve Baheuwu river (496.06 ha), Teluk Klowe (331.23 ha), Tanjung Laksaha (333.28 ha), Kioyo I & Kioyo II (305.00 ha), and Buru Gunung Nanua garden (7.271.00 ha). It also has protected forest Koho Buwa-Buwa and HPT. Ulu Malakoni.

Enggano is categorized to the oceanic island which had never joined to the big island. The oceanic islands usually have a prominent biogeophysical characteristic such as; (1) distinct from mainland island; (2) it has limited water resources, both surface water, and groundwater. The water catchment is relatively small so that the most of surface water and sediment flow into the sea; (3) sensitive and susceptible to external influences whether natural or due to human activities, such as storms and huge waves, as well as pollution; (4) Its water area is broader than land area and relatively isolated from the mainland (continents and large islands); and (5) doesn't have hinterland that far from the beach (Bengen, 2002).

The first collecting activity of flora in Enggano was performed probably by a mushroom expert from Netherland, W. J. Lutjeharms in 1936. In addition, the study aspects of biodiversity in Enggano re-done in 2004 and 2006 (Anonymous, 2004; Bapedalda, 2006). Nevertheless, there are still many biodiversity aspects of Enggano to be unsolved.

The information about bryophytes diversity from this island is not reported yet. Furthermore, data to of bryophytes in Sumatra is still lacking. Dixon recorded 172 species (Dixon, 1932), Ho et al. (2006) were recorded as many as 490 species and recently Windadri (2010) reported 37 species, of which 7 species are new records for Sumatra. Those data are the diversity of mosses in Sumatra. However, data of liverworts and hornworts have not been reported. Recently, little botanical work has been done in the area; the area has occasionally been visited by graduate students and researchers from the nearby institutions but publications are still lacking. Therefore, the expedition activities of Enggano Island conducted preliminary studies related to the diversity of bryophytes in Enggano. This activity is intend-

ed to provide preliminary information related to the diversity of bryophytes in Enggano.

METHODS

During the Bioresources Exploration in Enggano Island organized by Deputy for Life Sciences – Indonesian Institute of Sciences (LIPI), 16 April – 5 May 2015, participants spent 20 days collecting the area of Enggano Island. Exploration was conducted by using the method explained by Rugayah et al. (2005) in some forest area (primary, secondary, and damaged forest). This area included coastal area, river until the middle of the island. Bryophytes sample were taken about 10 cm² in each site. Some of the environmental parameters were recorded such as the habitat, air temperature, pH, and air moisture. GPS coordinates were recorded in the general area. A set of bryophyte collections was made, identified, and deposited at Cibodas Botanic Garden.

Bryophyte specimens were identified both morphological and anatomical features by using both keys and descriptions from various taxonomic literatures previously reported such as The Philippine Journal of Science (Bartram, 1939), A Handbook of Malesia Mosses (Eddy, 1990), A Taxonomic Revision of The Thuidiaceae (Musci) of Tropical Asia, The Western Pacific, and Hawaii (Touw, 2001) Thuidiopsis (Broth., Guide to the Liverworts and Hornworts of Java (Gradstein, 2009), Liverworts and Hornworts of Rwanda (Fischer, 2013), Malesian *Chaetomitrium* (Symphyodontaceae, Musci): Type Illustrations, Taxonomical Notes, and Key to The Species (Suleiman & Akiyama, 2014). The preliminary identification manual still lacked keys to some important genera especially in Sumatera and therefore the species could not be identified with certainty to species level.

RESULT AND DISCUSSION

Thirty-two collections number of bryophytes was identified. The following bryophyte list (Table 1) consists of 32 species, 21 genera, and 14 families (22 species of mosses, 10 species of liverworts and none of the hornwort).

Research Location

Research location in lowland forest. There wassix forest area in Enggano which consists primary forest and secondary forest including secondary forest near the coastal area. There were Koala Besar (secondary forest), Kaay Area (sec-

Table 1. List of Bryophytes found in Enggano Island

Family/Species	Group	Altitude (m asl)	Location						Forest Type
			KB	DK	BB	B	K	DH	
Aneuraceae <i>Riccardia</i> sp.	Liverwort	10	V						Secondary
Arnellaceae <i>Gongylanthus</i> sp.	Liverwort	48		V					Secondary
Calymperaceae <i>Leucophanes</i> sp.	Mosses	10	V						Secondary
<i>Calymperes</i> sp.	Mosses	5			V				Secondary near coastal area
Hypnaceae <i>Ectropothecium</i> sp1.	Mosses	48		V					Secondary
<i>Ectropothecium</i> sp2.	Mosses	48		V					Secondary
<i>Ectropothecium</i> sp3.	Mosses	48		V					Secondary
<i>Ectropothecium</i> sp4.	Mosses	48		V					Secondary
<i>Ectropothecium</i> sp5.	Mosses	30				V			Secondary
<i>Ectropothecium</i> sp6.	Mosses	5			V				Secondary near coastal area
<i>Isopterygium</i> sp.	Mosses	10	V						Secondary
<i>Taxyphyllum</i> sp.	Mosses	48		V					Secondary
<i>Vesicularia</i> sp.	Mosses	71					V		Primary
Jungermanniaceae <i>Jungermannia</i> sp.	Liverwort	14						V	Secondary
Lejeuneaceae <i>Lejeunea</i> sp1.	Liverwort	48		V					Secondary
<i>Lejeunea</i> sp2.	Liverwort	48		V					Secondary
<i>Lejeuneaceae</i> sp.1	Liverwort	48	V						Secondary
<i>Schiffneriolejeunea</i> sp.	Liverwort	5			V				Secondary near coastal area
<i>Spruceanthus</i> sp.	Liverwort	71					V		Primary
Lepidoziaceae <i>Bazzania</i> sp1.	Liverwort	48		V					Secondary
<i>Bazzania</i> sp2.	Liverwort	10	V						Secondary
Leucobryaceae <i>Leucobryum</i> sp1.	Mosses	71					V		Primary
<i>Leucobryum</i> sp2.	Mosses	5			V				Secondary near coastal area
Neckeraceae <i>Neckeropsis</i> sp.	Mosses	48		V					Secondary
Pallaviciniaceae <i>Symphyogyna</i> sp.	Mosses	5			V				Secondary near coastal area
Pterobryaceae <i>Pterobryopsis</i> sp.	Mosses	71					V		Primary
Sematophyllaceae <i>Mastopoma</i> sp.	Mosses	14						V	Secondary
Symphyodontaceae <i>Chaetomitrium</i> sp.	Mosses	48		V					Secondary
Thuidiaceae <i>Thuidium</i> sp1.	Mosses	48		V					Secondary
<i>Thuidium</i> sp2.	Mosses	30				V			Secondary
<i>Thuidium</i> sp3.	Mosses	14						V	Secondary
<i>Thuidium</i> sp4.	Mosses	10	V						Secondary

Notes : KB : Koala Besar Forest area – Malakoni Village; DK : Kaay Local Forest area – Meok Village; BB : Blak Blau Forest area – Meok Village; B : Bandara Forest Area –Banjarsari Village; K : Koho Buwa-Buwa Forest area; DH : Dusun Maham Forest area – Meok Village

ondary forest), Blak Bau (secondary forest, near coastal area), Bandara Forest (secondary forest), Koho Buwa-Buwa (primary forest), and Dusun Maham (secondary forest). In general, the sites are at 5 – 71 meters above sea level (m asl).

Primary forest previously was an indigenous area of Enggano island society, which has changed over a long period of time. It was characterized by high vegetation density and the number of trees with an over 30 cm of diameter. Secondary forests are forests around the community, airports, and in the coastal area. The most of the bryophytes were found in secondary forest areas due to the forest access which is easier. While the primary forest like protected forest, Koho Buwa-buwa, the location is still difficult to access, so that a few bryophytes sample were taken.

Habitat

The most common bryophytes in the area were epiphytes, both logs and tree trunks (Figure 1). The humid condition of forest in research location sufficiently support growth and development of bryophytes, especially epiphytic bryophytes. Flood and low tide of sea water at forest floor affected to the released spores of bryophytes. The tiny spores could be easily washed away and carried by the tides, so it couldn't grow on the forest floor (Windadri, 2009).

Species Diversity

The families of liverworts found in this study were Aneuraceae, Arnelliaceae, Lejeuneaceae, Jungermanniaceae, Lepidoziaeae, and Pallaviciniaceae. The common species were found from Lejeuneaceae. The families of mosses were dominated by Hypnaceae, Calymperaceae, Leucobryaceae, Neckeraceae, Pterobryaceae, Sematophyllaceae, Symphyodontaceae, and Thuidiaceae. Except Neckeraceae, Pterobryaceae, Symphyodontaceae, and Thuidiaceae. The result supported that those families dominated in the lowland forests (Haerida & Ho, 2014).

Hypnaceae was the most common family which was shown in this study. These pleurocarpous mosses were generally found in glossy mats. Among these species, there were two types that are found in watersheds such *Taxyphyllum* sp. (known as Java Moss) was found in Kaay Local Forest area – Meok Village and *Vesicularia* sp. (known as the Singapore moss) were found in primary forest, Koho Buwa-Buwa. These types were known as aquarium mosses (Tan et al., 2004; Akiyama, 2009), as widely used as an ornamental vegetation in the aquarium. Both types of moss are also very tolerant to the temperature and capable of absorbing ammonia from fish (Glime, 2006). Some other types are also showing potential biological activity, including *Riccardia* sp.



Figure 1. Types of common epiphytic bryophytes. A. *Neckeropsis* sp. on logs; B. *Ectropothecium* sp.1 on trees; C. *Ectropothecium* sp.2 on rotten wood; D. *Symphyogyna* sp. on rotten wood

which has cytotoxic activity and *Thuidium* sp. as an insect repellent (Alam, 2012).

In general, the species that were found in this study have ever been reported from Sumatra. There were two new records of genera are new records for Sumatra. This result was based on some literature which has been checked. *Gongylanthus* and *Symphogyna* have been reported from Java (Gradstein, 2009; Söderström et al., 2010; Söderström et al., 2016). *Gongylanthus* sp. and *Symphogyna* sp. also have an important record in terms of habitat. *Gongylanthus* sp. able to survive in locations with a rainfall of 200 mm per year (Glime, 2006). This species can be found in lowland forests which have an average rainfall of 222.8 mm per month or 2673.6 mm per year (Direktorat Pendayaan Pulau-Pulau Kecil, 2015). *Symphogyna* sp. usually can be found at high humidity (McCormick, 1914) and has been reported to be found at an altitude of 1700 to 1900 m asl (Iskandar, 2008). This species was found in Enggano at 5 m asl in the secondary forest near the coastal area.

CONCLUSION

Diversity moss in Enggano varied. Moss species have the potentiality to be developed among *Taxiphyllum* sp., *Vesicularia* sp., *Riccardia* sp., and *Thuidium* sp. Some genera were new records for Sumatra, there were *Gongylanthus*, *Symphogyna*, and *Mastopoma*. *Gongylanthus* sp. and *Symphogyna* sp. also has an important record in terms of habitat.

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