

ไบรโอไฟต์ในสวนรุกชาติหนองตาอยู่ จังหวัดชลบุรี
Bryophytes in Nong Tha Yu Arboretum, Chonburi province

เพียงพัทธ์ สุขรักรักษ์* และ จารุวรรณ พิเคราะห์ผล

Phiangphak Sukkharak* and Jaruan Pikroapol

ภาควิชาชีววิทยา คณะวิทยาศาสตร์ มหาวิทยาลัยบูรพา

บทคัดย่อ

จากการสำรวจและเก็บตัวอย่างไบรโอไฟต์ซึ่งประกอบด้วยมอสส์ ลิเวอร์เวิร์ต และฮอร์นเวิร์ตในสวนรุกชาติหนองตาอยู่ จังหวัดชลบุรี พบไบรโอไฟต์ทั้งหมด 12 ชนิด ประกอบด้วย มอสส์ 10 ชนิด 6 สกุล 6 วงศ์ ลิเวอร์เวิร์ต 2 ชนิด 2 สกุล 2 วงศ์ และไม่พบฮอร์นเวิร์ต มอสส์วงศ์ Fissidentaceae พบจำนวนชนิดมากที่สุดในพื้นที่ โดยพบ 3 ชนิด คือ *Fissidens ceylonensis* Dozy & Molk., *F. gedehensis* Fleisch. และ *F. zollingeri* Mont. หากพิจารณาในระดับปริมาณ ลิเวอร์เวิร์ต *Lejeunea wightii* Lendenb. ซึ่งอยู่ในวงศ์ Lejeuneaceae พบปริมาณมากที่สุด ไบรโอไฟต์ที่พบส่วนใหญ่เป็นชนิดที่เจริญบนพื้นทราย

คำสำคัญ : ชลบุรี / ไบรโอไฟต์ / สวนรุกชาติหนองตาอยู่

Abstract

An investigation of bryophytes including mosses, liverworts, and hornworts in Nong Tha Yu Arboretum in Chonburi province leads to the recognition of 12 species including mosses 10 species, six genera, and six families and liverworts two species, two genera, and two families. Hornworts are not found in the area. Among the eight families of bryophytes found, the Fissidentaceae is the most common family representing by three species including *Fissidens ceylonensis* Dozy & Molk., *F. gedehensis* Fleisch., and *F. zollingeri* Mont. Moreover, of all bryophytes species found, *Lejeunea wightii* Lendenb. of the Lejeuneaceae was the most common. Majority of bryophytes are terrestrial growing on sand.

Keywords : Chonburi / Bryophytes / Nong Tha Yu Arboretum

*Corresponding author. E-mail: phiangphak@buu.ac.th

Introduction

Bryophytes are non-vascular and spore producing land plants. They consist of mosses, liverworts, and hornworts. According to Frey and Stech (2009), there are approximately 17,900 species worldwide (12,500 mosses, 5,250 liverworts, 100-150 hornworts). About 1,101 species (708 mosses, 380 liverworts, 13 hornworts) are known in Thailand (Lai *et al.*, 2008; He, internet resource; Sukkharak and Chantanaorrapint, 2014). Most of them were reported from floristic work, focusing on particular areas especially from northern Thailand. In the eastern part of the country, only Khao Soi Dao Wildlife Sanctuary and mangrove forests in Chanthaburi province (Thaithong, 1984; Sukkharak, 2013; Sukkharak *et al.*, accepted) and beach forests in Chonburi province (Sukkharak and He, accepted b) have been explored.

Nong Tha Yu Arboretum covering a total area of 0.77 square kilometers is situated at 13°09' N latitude and 100°59' E longitude in Chonburi province. The elevation ranges from 57-86 m AMSL. The arboretum contains not only living collections of *Casuarina junghuhniana* Miq. in plantation area (Figure 1a) but also woody plants (e.g. *Artocarpus kemando* Miq., *Oroxylum indicum* (L.) Kurz., *Streblus asper* Lour.) in nature trail (Figure 1b-d). The study of bryophytes has not been taken place in this area before. The aim of this study, therefore, was to investigate bryophytes found in Nong Tha Yu Arboretum. List of bryophytes is presented in this paper.

Materials and Methods

The investigation of bryophytes in Nong Tha Yu Arboretum area including *Casuarina junghuhniana* plantation area and nature trail (Figure 1) was carried out from October-December 2013. Both morphological and anatomical features were studied. Bryophyte specimens were identified using both keys and descriptions from various taxonomic literatures previously reported. The specimens are kept in Department of Biology, Faculty of Science, Burapha University.

Results and Discussion

From 105 enumerated specimens, 12 species including mosses 10 species, six genera, and six families and liverworts two species, two genera, and two families were found (Table 1). All species are shown in the Figures 2-3. The classification system of the families and genera used

in this paper are followed Goffinet *et al.* (2008) and Crandall-Stotler *et al.* (2008) for mosses and liverworts, respectively.

Table 1 Alphabetical list of bryophytes found in Nong Tha Yu Arboretum

Families	Species	Altitude (m AMSL)	Habitat	Collecting numbers
MOSSES				
Archidiaceae	<i>Archidium crispulum</i> Schimp. (Figure 2a)	63-72	on sand	Sukkharak & Pikoapol 8, 27, 28, 29
	<i>Archidium ohioense</i> Schimp. ex Müll.Hal. (Figure 2b)	57	on sand	Sukkharak & Pikoapol 40
Calymperaceae	<i>Calymperes afzelii</i> Sw. (Figure 2c)	60-67	on barks	Sukkharak & Pikoapol 10, 12, 77
	<i>Calymperes tenerum</i> Müll.Hal. (Figure 2d)	61-84	on barks	Sukkharak & Pikoapol 13, 19, 22, 23, 35, 84, 86, 92, 97
Ditrichaceae	<i>Garckea flexuosa</i> (Griff.) Margad. & Nork. (Figure 2h)	71-73	on soil	Sukkharak & Pikoapol 100, 101, 102
Fissidentaceae	<i>Fissidens ceylonensis</i> Dozy & Molk. (Figure 2e)	61-73	on barks, sand	Sukkharak & Pikoapol 11, 17, 43, 87
	<i>Fissidens gedehensis</i> M.Fleisch. (Figure 2f)	75	on sand	Sukkharak & Pikoapol 90
	<i>Fissidens zollingeri</i> Mont. (Figure 2g)	57-78	on bark, rotten logs, sand, rocks, concrete floor	Sukkharak & Pikoapol 7, 20, 31, 32, 37, 41, 68, 78, 80, 81, 85, 88, 89, 91
Hypnaceae	<i>Pseudotaxiphyllum pohliaecarpum</i> (Sull. & Lesq.) Z.Iwats. (Figure 2i)	61	on barks	Sukkharak & Pikoapol 15
Pottiaceae	<i>Weissia edentula</i> Mitt. (Figure 2j)	78-82	on sand	Sukkharak & Pikoapol 93, 95
LIVERWORTS				
Lejeuneaceae	<i>Lejeunea wightii</i> Lindenb. (Figure 3a)	59-86	on barks	Sukkharak & Pikoapol 1, 2, 3, 4, 5, 6, 9, 14, 16, 18, 21, 24, 25, 26, 30, 33, 34, 36, 38, 42, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 69, 70, 71, 72, 73, 74, 75, 76, 79, 82, 83, 96, 98, 99, 103, 104, 105
Ricciaceae	<i>Riccia billardieri billardieri</i> Mont & Nees ex Gottsche et al. (Figure 3b)	58-79	on branches, sand	Sukkharak & Pikoapol 39, 94

Diversity of liverworts and species richness

Among the eight families of bryophytes found, the Fissidentaceae was the most common family with respect to species diversity representing by three species including *Fissidens ceylonensis* (Figure 2e), *F. gedehensis* (Figure 2f), and *F. zollingeri* (Figure 2g). These species are widespread and locally common throughout tropical Asia and Malesia (Eddy, 1988). Of all bryophyte species found, *Lejeunea wightii* (Figure 3a) of the Lejeuneaceae was the most common in the area.



Figure 1 Study areas and Bryophytes found in Nong Tha Yu Arboretum: (a) *Casuarina junghuhniana* Miq. plantation area., (b-d) nature trail.



Figure 2 Mosses found in Nong Tha Yu Arboretum: (a) *Archidium crispulum* Schimp., (b) *Archidium ohioense* Schimp. ex Müll.Hal., (c) *Calymperes afzelii* Sw., (d) *Calymperes tenerum* Müll.Hal., (e) *Fissidens ceylonensis* Dozy & Molke., (f) *F. gedehensis* M.Fleisch., (g) *F. zollingeri* Mont., (h) *Garckea flexuosa* (Griff.) Margad. & Nork., (i) *Pseudotaxiphyllum pohliaecarpum* (Sull. & Lesq.) Z.Iwats., (j) *Weissia edentula* Mitt.



Figure 3 Liverworts found in Nong Tha Yu Arboretum: (a) *Lejeunea wightii* Lindenb, (b) *Riccia billardieri* Mont & Nees ex Gottsche et al.

Habitat of bryophytes

Regarding habitat, of twelve species inhabiting this area, five species were terrestrial, four species were epiphyte, and three species were found both as epiphytes and on the floor. Majority of bryophytes were terrestrial growing on sand.

Comparison of bryophyte diversity to previous studies in eastern part of Thailand

When compared to beach forests in Chonburi province and mangrove forests in Chanthaburi province, *Calymperes tenerum* (Figure 2d) is commonly found in these three areas. It seems like that physical factors such as drought may play an important role in their distribution. Although Nong Tha Yu Arboretum and Khao Soi Dao Wildlife Sanctuary, in which the highest area reaches 1,675 m AMSL are different in altitude, *Calymperes afzelii* (Figure 2c) is common to both areas (Table 2).

Conclusion

An investigation of bryophytes in Nong Tha Yu Arboretum in Chonburi province leads to the recognition of 12 species including mosses 10 species, six genera, and six families and liverworts two species, two genera, and two families. Hornworts are not found in the area. The results of the study increase the knowledge on bryophytes in plant communities in the eastern part of Thailand, in which few studies have been conducted.

Table 2 Comparison of bryophytes found in Nong Tha Yu Arboretum to previous study areas in eastern part of Thailand.

Species	Area	Beach forests in Chonburi province (Sukkarak et al., accepted b)	Mangrove forest in Chanthaburi province (Thaithong, 1984)	Khao Soi Dao Wildlife Sanctuary (Sukkarak et al., accepted a)
<i>Archidium crispulum</i> Schimp.		-	-	-
<i>Archidium ohioense</i> Schimp. ex Müll.Hal.		-	-	-
<i>Calymperes afzelii</i> Sw.		-	-	✓
<i>Calymperes tenerum</i> Müll.Hal.		✓	✓	-
<i>Fissidens ceylonensis</i> Dozy & Molk.		✓	-	-
<i>Fissidens gedehensis</i> M.Fleisch.		-	-	-
<i>Fissidens zollingeri</i> Mont.		-	-	-
<i>Garckea flexuosa</i> (Griff.) Margad. & Nork.		-	-	-
<i>Lejeunea wightii</i> Lindenb.		✓	-	-
<i>Pseudotaxiphyllum pohliaecarpum</i> (Sull. & Lesq.) Z.Iwats.		-	-	-
<i>Riccia billardieri billardieri</i> Mont & Nees ex Gottsche et al.		-	-	-
<i>Weissia edentula</i> Mitt.		✓	-	-

Acknowledgements

We thank to Department of National Parks, Wildlife and Plant Conservation for their kindly permission of collecting activities in Nong Tha Yu Arboretum, Chonburi province.

References

- Crandall-Stotler, B.J., Stotler, R.E., and Long, D.G. (2008). Morphology and classification of the Marchantiophyta. In B. Goffinet and A.J. Shaw (Eds.), *Bryophyte Biology*, 2nd edition. Cambridge: Cambridge University Press. 1-54.
- Eddy, A. (1988). *A handbook of Malesian Mosses. Volume 1 Sphagnales to Dicranales*. London: British Museum (Natural History).
- Frey, W. and Stech, M. (2009). Marchantiophyta, Bryophyta, Anthocerotophyta. In W. Frey, (Ed.), *Syllabus of plant families – A. Engler's Syllabus der Pflanzenfamilien. 13th ed., part 3. Bryophytes and seedless vascular plants*. Stuttgart: Schweizerbart. 13-263.

- Goffinet, B., Buck, W.R., and Shaw A.J. (2008). Morphology and classification of the Bryophyta. In B. Goffinet and A.J. Shaw (Eds.), *Bryophyte Biology*, 2nd edition. Cambridge: Cambridge University Press. 55-138.
- He, S. (internet resource). An annotated checklist and atlas of the mosses of Thailand. The moss flora of Thailand Home Page. Missouri Botanical Garden, St. Louis, USA. Retrieved January 2, 2014, from <http://www.mobot.org/MOBOT/moss/Thailand/>
- Lai, M.-J., Zhu, R.-L. and Chantanaorrapint, S. (2008). Liverworts and hornwort of Thailand: an updated checklist and bryofloristic accounts. *Annales Botanici Fennici*, 45, 321-341.
- Sukkharak, P. 2013. *Jubula hutchinsiae* subsp. *javanica* (Hepaticae: Jubulaceae): a genus and species new to Thailand. *Polish Botanical Journal*, 58(2), 585-587.
- Sukkharak, P. and Chantanaorrapint, S. (2014). Bryological studies in Thailand: past, present, and future. *Cryptogamie, Bryologie*, 35, 5-17.
- Sukkharak, P., Kitlap, P., Likananon, A. and He, S. (accepted a). A preliminary study of bryophytes of Khao Soi Dao wildlife sanctuary, Chanthaburi province, Thailand. *Songklanakarin Journal of Science and Technology*.
- Sukkharak, P. and He, S. (accepted b). Bryophytes of beach forests in Chonburi province, Thailand. *Songklanakarin Journal of Science and Technology*.
- Thaithong, O. (1984). Bryophytes of the mangrove forest. *Journal of the Hattori botanical laboratory*, 56, 85-87.