

B5_020_Pf: DIVERSITY OF FOLIICOLOUS LICHENS ON *Acrostichum aureum* L. IN MANGROVE FOREST FROM CHUMPHON PROVINCE

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Abstract: Foliicolous lichens grow entirely on the living leaves of vascular plants. Thailand has high foliicolous lichens with about 180 species which most of them were reported from the high altitudes in northern and northeast parts. Whereas, a few of foliicolous lichens in mangrove forest have been studied. The aim of this study was to investigate the diversity of foliicolous lichens on *Acrostichum aureum* L. in mangrove forests of Chumphon province. A total of 152 specimens were collected from living leaves of *Acrostichum aureum* L. during 14–16 February 2018. The external morphology was determined under a dissecting binocular microscope. The anatomical characters of the thallus and ascomata were studied by free hand section and observed under a compound microscope. Lichen substances were characterized by spot tests. In the present study 5 families, 6 genera and 7 species were recorded including *Arthonia lividula* Vain., *Byssoloma subdiscordans* (Nyl.) P. James, *Calopadia fusca* (Müll. Arg.) Vězda, *Calopadia puiggarii* (Müll. Arg.) Vězda, *Dirinaria confluens* (Fr.) D.D. Awasthi, *Porina nitidula* Müll. Arg. and *Tricharia demoulinii* Sérus. Among them, *Porina nitidula* was commonly found with 70 observing specimens. The key to all species of foliicolous lichens that colonizing on live leaves of *Acrostichum aureum* L. was provided together with their pictures.

Introduction: Chumphon province is located at the top of the southern region (10° 29'N/99° 11'E) on the east coast of Thailand approximately 6,010 km². The general geography is long and narrow comprising of high mountains and lowlands. In addition, there are plains along the coast of the Gulf of Thailand, which is plentiful of mangrove forests and several of mangrove plants such as *Acrostichum aureum* L.

Acrostichum aureum L. is a species of fern that grows in mangrove swamps. This plant is one of the interesting mangrove phorophyte for species diversity study of foliicolous lichens because of its glossy, thick, broad and large leaves that are suitable for growth of lichens on leaves, called foliicolous lichens.

Foliicolous lichen grows and reproduces on surfaces living leaves consisting of the upper surface (epiphyllous) and occasionally at lower surface (hypophyllous). Most of them are found in tropical areas where high humidity and low light intensity prevail¹ and with more than 800 species have been reported worldwide.²

The foliicolous lichens in Thailand were first reported by Boonpragob *et al.*³, who examined specimens from a few sites in Khao Yai National Park and listed 34 lichen species. Papong *et al.*¹ published a new species and 71 new records of foliicolous species collected from five different forest types in Khao Yai National Park. The rich number of foliicolous lichen species were reported by Aptroot *et al.*⁴, who studied lichen mainly microlichens from Chiang Mai province. Buaruang *et al.*⁵ published a checklist of lichens in Thailand with 1,292 taxa of which about 180 are foliicolous lichens. It is clearly seen that most collections of foliicolous lichens have been reported in Thailand mainly from the high altitude of northern and northeastern parts. Therefore, the objective of this study was to study the diversity of foliicolous lichens that live on *Acrostichum aureum* L., in the mangrove forest from Chumphon province.

Methodology: A total of 152 samples of the foliicolous lichens growing on the leave of *Acrostichum aureum* L. in mangrove forests of Chumphon province were collected from two

collection sites; (1) Bang Son Subdistrict, Pathio District (10° 41.494'N 99° 19.870'E) and (2) Bang Nam Chuet Subdistrict, Lang Suan District (10° 3.470'N 99° 8.271'E) (Figure 1), during 14–16 February 2018. All the specimens were air dried with wood panel in room temperature for a week before identification. The external morphological characters of thallus and ascomata were examined with an Olympus SZ30 stereomicroscope and images were made by microscope Eye-Piece Camera (Dino-Eye). The anatomical features were investigated by hand-cut section of thalli and ascoma by razor blade. The iodine reaction of the hymenium and ascospores were studied in Lugol's iodine solution. All sections were mounted in water and observed under light microscope (Olympus CH). Lichen chemistry of thalli and ascomata were characterized by spot tests as follow Lucking 2008, Swinscow and Krog 1988, Ferraro and Lucking 1997, Singh, and Pinokiyo 2018. The specimens were identified by comparing by own description and specimens in the herbarium of lichen research unit of Ramkhamhaeng University.

Results and Discussion: The foliicolous lichens that colonize on live leaves of *Acrostichum aureum* L. in the mangrove forest of Chumphon Province were identified to seven species belonging to six genera in five families. The lists of lichen species and number of specimens together with their photobionts were shown in Table 1. Two genera of photobionts were observed namely *Phycopeltis* and *Trebooxia* (Table 1 and Figure 2) of which five species of lichenized fungi were found associated with photobiont genus *Trebooxia* and other two lichen species were symbiosis with the algal genus *Phycopeltis*. Family Pilocarpaceae dominated with 3 species namely *Byssoloma subdiscordans* (Nyl.) P. James, *Calopadia fusca* (Müll. Arg.) Vězda and *Calopadia puiggarii* (Müll. Arg.) Vězda and the rest families with one species each were recorded (Table 1). Study area site, Lang Suan district (2) had more species diversity of lichens than site Pathio district (1). All seven species were found in the study site (2) whereas only two species namely *Calopadia puiggarii* and *Porina nitidula* were observed in the site (1). *Porina nitidula* was commonly found in this study with 70 specimens, following by *Calopadia fusca*, *Byssoloma subdiscordans* and *Arthonia lividula* with 18, 18 and 16 specimens, respectively. The foliicolous lichens on *Acrostichum aureum* L. were dominated by crustose growth form with 6 species and foliose growth form with one species (Table 1). *Byssoloma subdiscordans* (Nyl.) P. James and *Dirinaria confluens* (Fr.) D.D. Awasthi, that grows as foliicolous are also found as corticolous.⁹ Whereas, *Arthonia lividula* Vain., *Calopadia puiggarii* (Müll.Arg.) Vězda and *Tricharia demoulinii* Sérus have been reported in Thailand as only foliicolous lichens.^{1,4,5} In addition, all seven species found in this study have never been reported in mangrove forest of Thailand so far. Thus, we constructed the key for lichens that colonized on leaves of *Acrostichum aureum* L. for the first time on the basis of their morphological, anatomical and chemical characters.



Figure 1. A. Map of two collection sites in Chumphon province; (1) Pathio district, (2) Lang Suan district. B. *Acrostichum aureum* L. hosted of foliicolous lichens. C. Mangrove forest at Chumphon province.

Table 1. List of foliicolous lichen on *Acrostichum aureum* L. in the mangrove forest of Chumphon province.

Family	Lichen species	Growth form	Photobionts	Number of specimens		
				Site 1	Site 2	Total
Arthoniaceae	<i>Arthonia lividula</i>	Crustose	<i>Phycopeltis</i>	-	16	16
Caliciaceae	<i>Dirinaria confluens</i>	Foliose	<i>Treboxia</i>	-	8	8
Gomphillaceae	<i>Tricharia demoulinii</i>	Crustose	<i>Treboxia</i>	-	14	14
Pilocarpaceae	<i>Byssoloma</i>	Crustose	<i>Treboxia</i>	-	18	18
	<i>subdiscordans</i>					
	<i>Calopadia fusca</i>	Crustose	<i>Treboxia</i>	-	5	5
	<i>Calopadia puiggarii</i>	Crustose	<i>Treboxia</i>	3	18	21
Porinaceae	<i>Porina nitidula</i>	Crustose	<i>Phycopeltis</i>	27	43	70
Total specimens				30	122	152

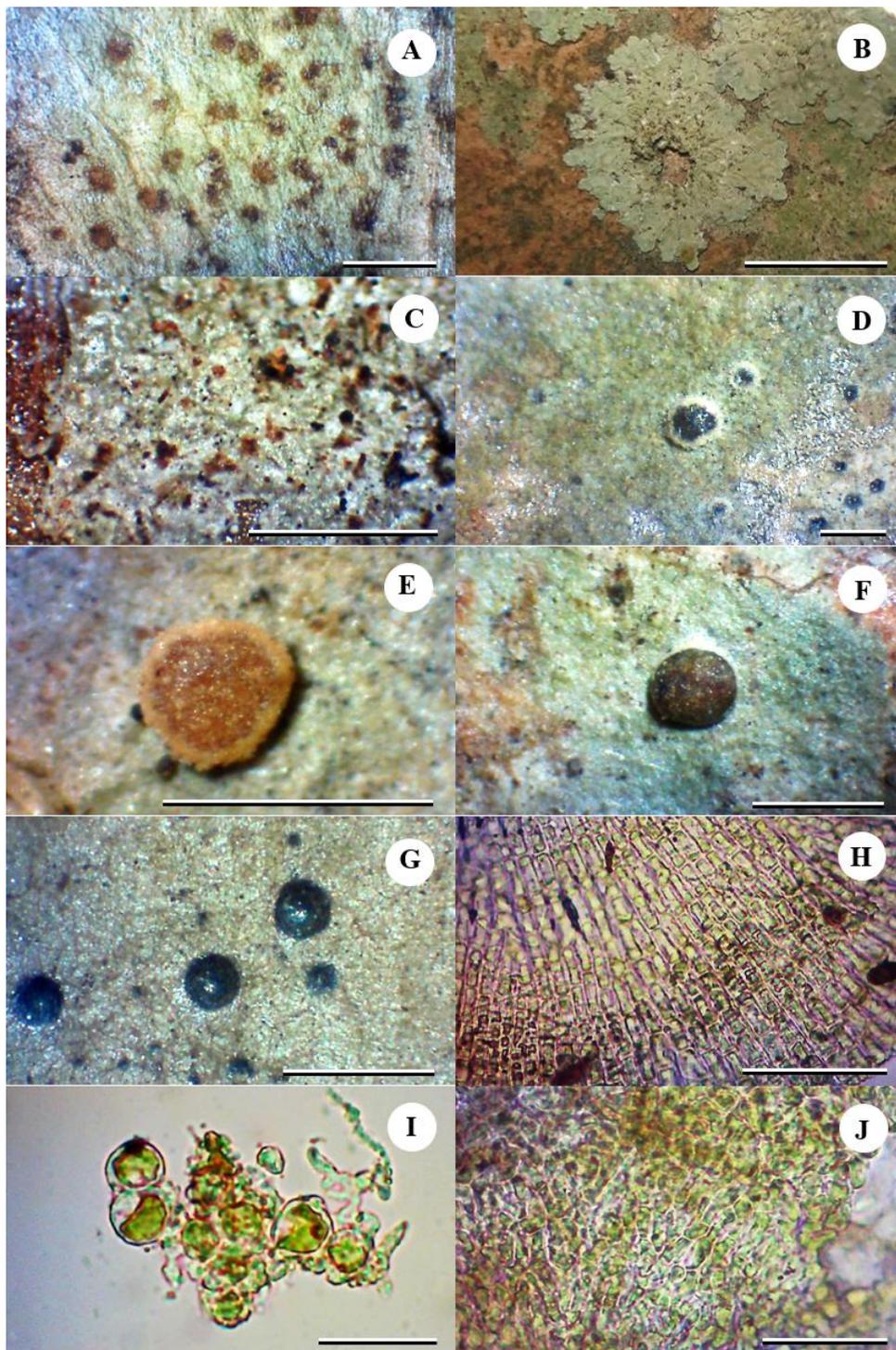


Figure 2. Follicolous lichens and their photobionts that colonize on *Acrostichum aureum* L.
 A. *Arthonia lividula*, B. *Dirinaria confluens*, C. *Tricharia demoulinii*, D. *Byssoloma subdiscordans*, E. *Calopadia fusca*, F. *Calopadia puiggarii*, G. *Porina nitidula*,

- H. Photobiont *Phycopeltis* (*Arthonia lividula*) I. Photobiont *Trebouxia* (*Dirinaria confluens*),
 J. Photobiont *Phycopeltis* (*Porina nitidula*). Scale for A–G = 0.5 mm.; for H–J = 50 µm.

Key to foliicolous lichens on *Acrostichum aureum* L. in Chumphon province

- 1a. Thallus foliose..... *Dirinaria confluens*
 1b. Thallus crustose..... 2
 2a. Ascomata perithecia; photobiont trentepohlioid
 (*Phycopeltis*)..... *Porina nitidula*
 2b. Ascomata apothecia; photobiont chlorococcoid
 (*Trebouxia*) or trentepohlioid (*Phycopeltis*)..... 3
 3a. Apothecia irregular lirellate brownish, pale margin and
 lacking algae; ascospore transversely septate, small (6–25 ×
 2–8 µm); photobiont trentepohlioid (*Phycopeltis*)..... *Arthonia lividula*
 3b. Apothecia disc-like; photobiont chlorococcoid
 (*Trebouxia*)..... 4
 4a. Apothecia yellowish to dark brown to black; sterile setae
 present, black..... *Tricharia demoulinii*
 4b. Apothecia greyish brown to dark brown; setae
 absent..... 5
 5a. Apothecia black, margin well-developed and densely
 byssoid, pure white; ascospore oblong-ellipsoid,
 transversely
 septate..... *Byssoloma subdiscordans*
 5b. Apothecial disc dark brown; ascospore
 muriform..... 6
 6a. Apothecia light brown to reddish brown; hypothecium
 light
 brown..... *Calopadia fusca*
 6b. Apothecia greyish brown to dark brown; hypothecium
 dark
 brown..... *Calopadia puiggarii*

Conclusion: One hundred and fifty-two specimens of foliicolous lichens on *Acrostichum aureum* L. in the mangrove forest from Chumphon province were classified into 5 families 6 genera and 7 species. The highest lichen species diversity found on *Acrostichum aureum* L. was in family Porinaceae with three species. *Porina nitidula* was species that commonly found in two study sites. All of seven species have never been found in mangrove forests of Thailand before. Therefore, the findings of this study lead to a better understanding of the diversity and distribution of foliicolous lichens in the southern part of Thailand.

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