

H_H0025: BIODIVERSITY OF THE LICHEN FAMILY GRAPHIDACEAE IN MANGROVE FOREST, RAYONG PROVINCE

Vasun Poengsungnoen, Pachara Mongkolsuk*

Lichen Research Unit, Department of Biology, Faculty of Science, Ramkhamhaeng University, Thailand

*e-mail: pm-tamrapap@ru.ac.th

Abstract: The objective of this study was to explore the diversity of lichen family Graphidaceae in mangrove forest, Rayong Province. Three hundred and ninety specimens were collected from mangrove trees. The anatomy of thallus and ascomata were examined from hand-cut sections in tap water. The secondary metabolites were characterized by spot test and thin layer chromatography according to the standard methods. The present study include 8 genera; *Diorygma*, *Dyplolabia*, *Glyphis*, *Graphis*, *Leucodecton*, *Phaeographis*, *Sarcographa* and *Thelotrema* and 15 species of which one unidentified species is expected to be a new to science.

Introduction: The lichenized fungal family Graphidaceae is one of the largest families among lichen-forming fungi which formed from fungi in Ascomycota and green algae (Chlorophyta) of the genera *Trentepohlia* or *Trebouxia* as a mutualistic association^{1,2}. There are over 2500 species currently known³. It includes taxa with widely differing morphological and anatomical characters of ascomata. Ascoma shapes vary widely within the family, including rounded to lirellate apothecia or perithecia^{4,5,6}. In addition, ascoma can be solitary or aggregate^{7,8}. These lichens have widely distributed in tropical and subtropical regions. They can grow on different substrates such as tree barks, rocks, soil, leaves, mosses and other lichens and they can distribute in various forest types.

Several studies have been reported that mangroves play a role as home for many lichen species^{9,10,11} which some of them are unique for this ecosystem. Although, there are about 2,440 km² of mangrove forest in Thailand but most of them are unexplored sites. Thus, the purpose of this study was to investigate the undiscovered mangrove area for providing more knowledge about diversity of lichen family Graphidaceae in mangrove.

Methodology: The morphology of thallus was examined using Olympus model SZ30 dissecting microscopes. Anatomical features were studied on hand-cut sections of thallus and ascomata mounted in water and examined using OLYMPUS-CH compound microscopes. The iodine reaction of the hymenium and ascospores were studied in Lugol's iodine solution. Photos were taken with a Canon EOS650D. The secondary metabolites were characterized by spot test and thin layer chromatography (TLC) according to methods standardized by Elix & Ernst-Russell¹².

Results and Discussion: The diversity of lichen family Graphidaceae in mangrove of Rayong province was explored during October 2014 to March 2015. We have studied 390 specimens. All consist of 15 species belonging 8 genera: *Diorygma* Eschw., *Dyplolabia* A. Massal., *Glyphis* Ach., *Graphis* Adans., *Leucodecton* A. Massal., *Phaeographis* Müll. Arg., *Sarcographa* Müll. Arg. and *Thelotrema* Ach. The genus *Graphis* Adans. was the highest diversity with 5 species of which two species of them were also reported from similar habitat in India¹¹ (Sandarbans Biosphere Reserve) namely *G. scripta* (L.) Ach. and *G. sundarbanensis* Jagadeesh & G.P. Sinha. It is followed by genus *Phaeographis* by 4 species; *P. brasiliensis* (A. Massal.) Kalb & Matthes-Leicht, *P. intricans* (Nyl.) Staiger, *P. inusta* (Ach.) Müll. Arg. and *P. inustoides* Fink. The number of species in other genera is

summarized in Table 1. The common species were *G. streimannii* A.W. Archer (140 specimens) *G. analoga* Nyl. (130 specimens) and *L. occultum* (Eschw.) Frisch (79 specimens) (Figure 1. A-C). Whereas, *Di. hieroglyphicum* (Pers.) Staiger & Kalb, *Dy. afzelii* (Ach.) A. Massal., *G. furcata* Fée, *G. sundarbanensis* Jagadeesh & G. P. Sinha, *P. inusta* (Ach.) Müll. Arg. and *S. glyphiza* (Nyl.) Kr. R. Singh & G.P. Sinha were only found one specimen. The number of specimens and species occurrence on various phorophytes is summarized in Table 1. In addition, during the identification of the samples, an undescribed species was observed and expected to be a new to science. This unidentified species belong to the genus *Thelotrema* (Figure. 1D).

Table 1. The number of lichen specimen occurrence on mangrove tree species.

Lichen species	Mangrove tree species											No. of specimen
	1	2	3	4	5	6	7	8	9	10	11	
<i>Diorygma hieroglyphicum</i>									1			1
<i>Dyplolabia afzelii</i>					1							1
<i>Glyphis scyphulifera</i>						1			1			2
<i>Graphis analoga</i>	1	8	3	2	16	17	2	22	54	2	3	130
<i>Graphis furcata</i>						1						1
<i>Graphis scripta</i>											2	2
<i>Graphis streimannii</i>	2	5	1	7	15	23	3	50	22	4	8	140
<i>Graphis sundarbanensis</i>											1	1
<i>Leucodecton occultum</i>		6		1	5	8		42	17			79
<i>Phaeographis brasiliensis</i>		4		1		1		1				7
<i>Phaeographis intricans</i>		4		1				1				6
<i>Phaeographis inusta</i>								1				1
<i>Phaeographis inustoides</i>								10				10
<i>Sarcographa glyphiza</i>		1										1
<i>Thelotrema</i> sp.1								8				8
Total lichen species	2	6	2	5	4	6	2	8	5	2	4	390

Note: 1 = *Avicennia alba*; 2 = *Bruguiera cylindrical*; 3 = *Bruguiera sexangule*; 4 = *Ceriops decandra*; 5 = *Ceriops tagal*; 6 = *Excoecaria agallocha*; 7 = *Lumnitzera littorea*; 8 = *Lumnitzera racemosa*; 9 = *Rhizophora apiculata*; 10 = *Sonneratia caseolaris*; 11 = *Thespesia populnea*.

The number of specimens on mangrove tree species was recorded. The highest number of lichen specimens was found on *Lumnitzera racemosa* Willd. with 135 specimens (35%), followed by *Rhizophora apiculata* Bl. with 95 specimens (24%) and *Excoecaria agallocha* L. with 51 specimens (13%) (Figure 2). The number of lichen species occurrence on mangrove trees was also observed. The results showed that *L. racemosa* Willd. promoted the highest species rich of lichens with 8 species, following by *Bruguiera cylindrical* (Linnaeus) Blume (6 species), *E. agallocha* L. (6 species), *Ceriops decandra* Ding Hou (5 species), *R. apiculata* Bl. (5 species), *Ceriops tagal* (Peer.) C. B. Rob. (4 species), *Thespesia populnea* (L.) Solander ex Correa (4 species), and *Avicennia alba* Bl. (2 species), *Bruguiera sexangule* Poir. (2 species), *Lumnitzera littorea* Voigt (2 species) and *Sonneratia caseolaris* (L.) Engl. (2 species). *G. analoga* and *G. streimannii* were found on all observed mangrove tree species. Although, there were 8 specimens of *Thelotrema* sp. 1 were observed but all of them were only found on *Lumnitzera racemosa*. Even though most of graphidoid members can grow on different substrates and geographical regions. However, some species have been

found on mangrove trees only. For example, *G. strimannii* has so far been observed in Australia only on mangrove trees¹³. Similar result was found in the present study that this lichen species only grow on mangrove phorophytes which has not been reported in any other forest types in Thailand.

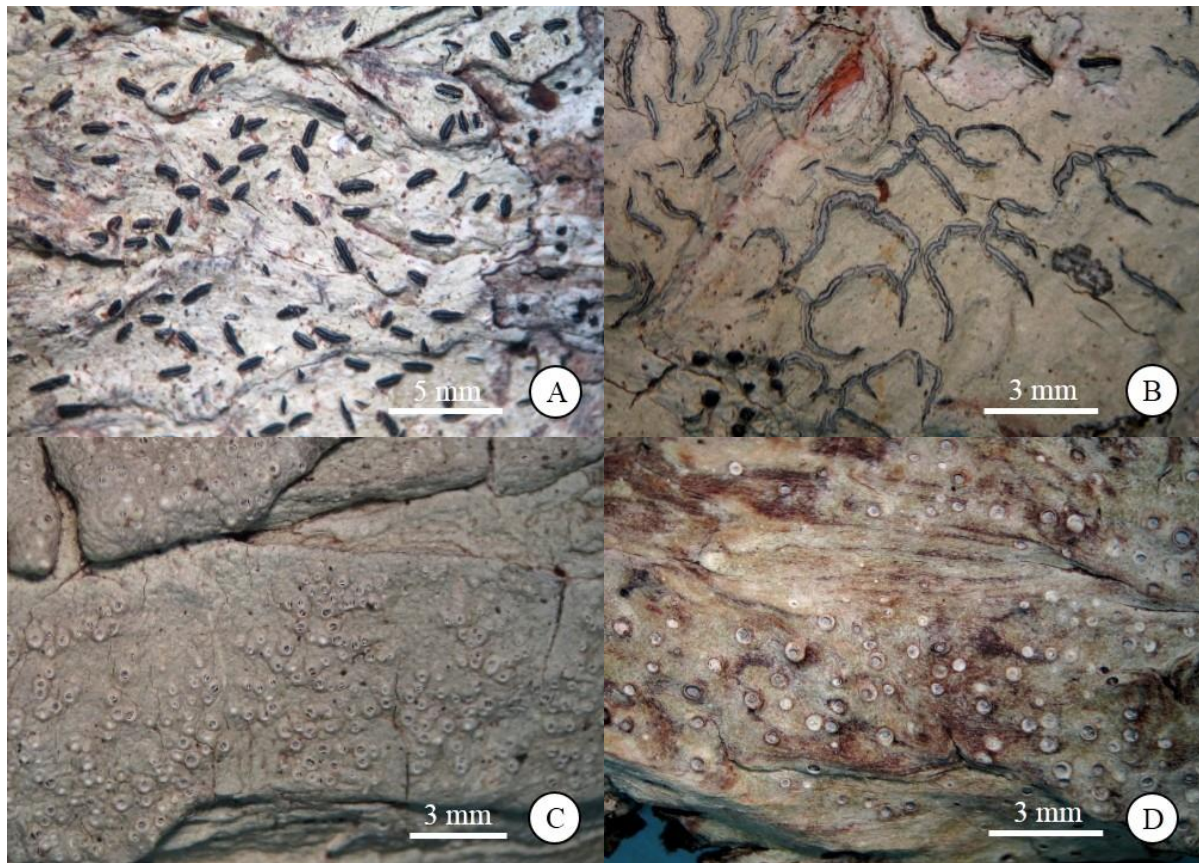


Figure 1. A. *Graphis analoga*, thallus with short ascomata; B. *G. streimannii*, thallus with elongate ascomata; C. *L. occultum*, thallus with rounded ascomata; D. *Thelotrema* sp.1, thallus with rounded ascomata.

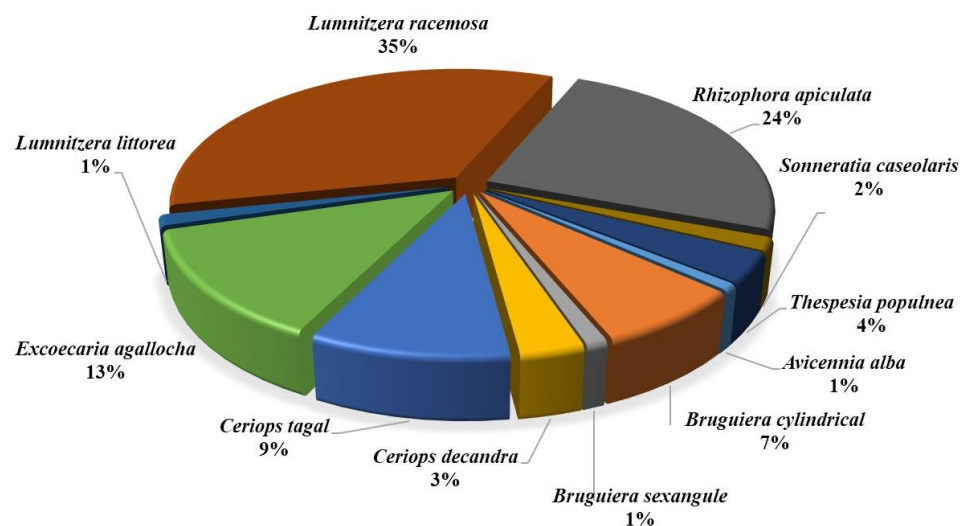


Figure 2. The percentage of lichen specimen occurrence on mangrove tree species.

Conclusion: The diversity of lichen family Graphidaceae in mangrove of Rayong province was investigated. Altogether 390 specimens were collected from various mangrove trees. They were identified into 15 species under 8 genera of which an undescribed species was observed. Our results confirmed that mangroves have specialized characters and differ from other ecosystems which are favorable for some specific lichens to grow on this forest type.

References:

1. Lücking R. *The Lichenologist*. 2009;41:319-362.
2. Mangold A, Martín MP, Lücking R, Lumbsch HT. *Taxon*. 2008;57:476-486.
3. Kraichak K, Parnmen S, Lücking R, Rivas Plata E, Aptroot A, Caceres MES, Ertz D, Mangold A, Mercado-Díaz JA, Papong K, Van den Broeck D, Weerakoon G, Lumbsch HT. *Phytotaxa*. 2014;189(1):052-081.
4. Parnmen S, Lücking R, Lumbsch HT. *PLoS One*. 2012;7(12):e51392.
5. Rivas Plata E, Lumbsch HT. *Phylogenet. Evol.* 2011;61:45-63.
6. Lumbsch HT, Mangold A, Martin MP, Elix JA. *Aust Syst Bot.* 2008;21:217-227.
7. Papong K, Lücking R, Thammathaworn A, Boonpragob K. *The Bryologist*. 2009; 112:152-163.
8. Poengsungnoen V, Manoch L, Mongkolsuk P, Boonpragob K, Parnmen S, Lücking R, Tehler A, Lumbsch HT. *Phytotaxa*. 2014;189(1):268-281.
9. Marcelli MP. *Biblioth. Lichenol.* 199;47:1-310.
10. Nakanishi S. *Hikobia*. 1964;4(1-2);124.
11. Ram J, Sinha GP, Singh KP. Lichen flora of Sundarbans Biosphere Reserve, West Bengal. 2012;384.
12. Elix JA, Ernst-Russell KD. A catalogue of standardized thin layer chromatographic data and biosynthetic relationships for lichen substances, second ed., 1993.
13. Archer AW. *Biblioth. Lichenol.* 2006;94:1-191.

Acknowledgements: We are grateful to the Lichen Research Unit, Department of Biology, Faculty of Science, Ramkhamhaeng University, for providing the necessary facilities for our works. We gratefully acknowledge to Royal Thai Government for the financial support.