

## SP11\_009\_PF: *Relicina* (LICHENIZED ASCOMYCOTA) IN THAILAND

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### Abstract:

Members of the genus *Relicina* (Parmeliaceae) were distinguishable by having yellowish green thalli. In addition, they had lobe shape sublinear to subirregular with margins entire crenate or serrate, and apice incised to truncate. Simple, furcate or agglutinate rhizine was developed from the lower cortex. The bitunicate ascus contained hyaline, simple and ellipsoid ascospores. Conidia were bifusiform. Based on a phylogenetic analysis, the genus *Relicinopsis* has been proposed as a subgenus of *Relicina*. Twelve species of *Relicina* occurred in Thailand. Usnic acid was a chemical substance found in the upper cortex. Medullary substances included 4-O-demethylbarbatic acid, barbatic acid, caperatic acid, echinocarpic acid, fumarprotocetraric acid, hyposalazinic acid, norstictic acid, protocetraric acid and succinprotocetraric acid.

### Introduction:

Currently in Parmeliaceae c. 80 genera are accepted based on phenotypic features and analyses of multilocus sequence data<sup>2, 14</sup>. The largest group within the family is the parmelioid core, where the genera *Relicina* (Hale & Kurok.) Hale and *Relicinopsis* Elix & Verdon are belonged<sup>1</sup>. *Relicina* is differentiated from *Parmelia* Ach. s. lat.<sup>8</sup> by having bulbate marginal cilia, bifusiform conidia and containing usnic acid in the upper cortex. The related genera are *Bulbothrix* and *Relicinopsis*. *Bulbothrix* has grayish green color on the upper cortex and containing atranorin, whereas *Relicinopsis* is distinguished by the absence of bulbate cilia and has yellowish green color on the upper surface which contains usnic acid. Kirika et al. proposed to reduce the genus *Relicinopsis* to a subgenus of *Relicina*.<sup>12</sup> This genus includes c. 54 species<sup>14</sup> with the center of distribution in South-East Asia (including Thailand) and Australasia<sup>4, 10</sup>.

### Methodology:

Lichen samples collected from 9 provinces were dried under room temperature for taxonomic study. All specimens were examined for their morphological and anatomical characteristics and chemistry as follows. For macroscopic examination, the morphology of the thallus including lobe size, rhizines, cilia, vegetative propagules (isidia, soredia, phyllidia and pustule), reproductive structure, color and surface texture were examined by using low magnification stereomicroscope (Olympus SZ30). For microscopic examination, the anatomical characters of thallus including reproductive structure, apothecia and pycnidia were free-hand sectioned with the aid of razor blade. Investigation of the fine structures was performed under light microscope (Olympus CH and Olympus BX51). The investigation of chemical characters was performed by spot test<sup>5</sup> and Thin Layer Chromatography (TLC)<sup>15</sup>. Taxa were determined according to books and publications of this genus<sup>3, 6, 7, 9, 10, 11, 13</sup> and all specimens were preserved at the Lichen Herbarium of Ramkhamhaeng University.

### Results and Discussion:

From various morphological characters of *Relicina* (Figure 1), a total of 12 species were reported in Thailand. *Relicina abstrusa*, *R. circumnodata*, *R. palmata*, *R. planiuscula*, *R. polycarpa*, *R. subabstrusa*, *R. subconnivens*, *R. sublanea*, *R. sublimbata* belonging to the genus *Relicina* (Hale & Kurok.) Hale, were characterized by thallus colors being yellowish green. Lobe shape, sublinear to subirregular with margins entire crenate or serrate with bulbate cilia, apice incised to truncate were found. Simple, furcate or agglutinate rhizine, was developed from the lower cortex. The bitunicate ascus contained hyaline, simple and ellipsoid ascospores.

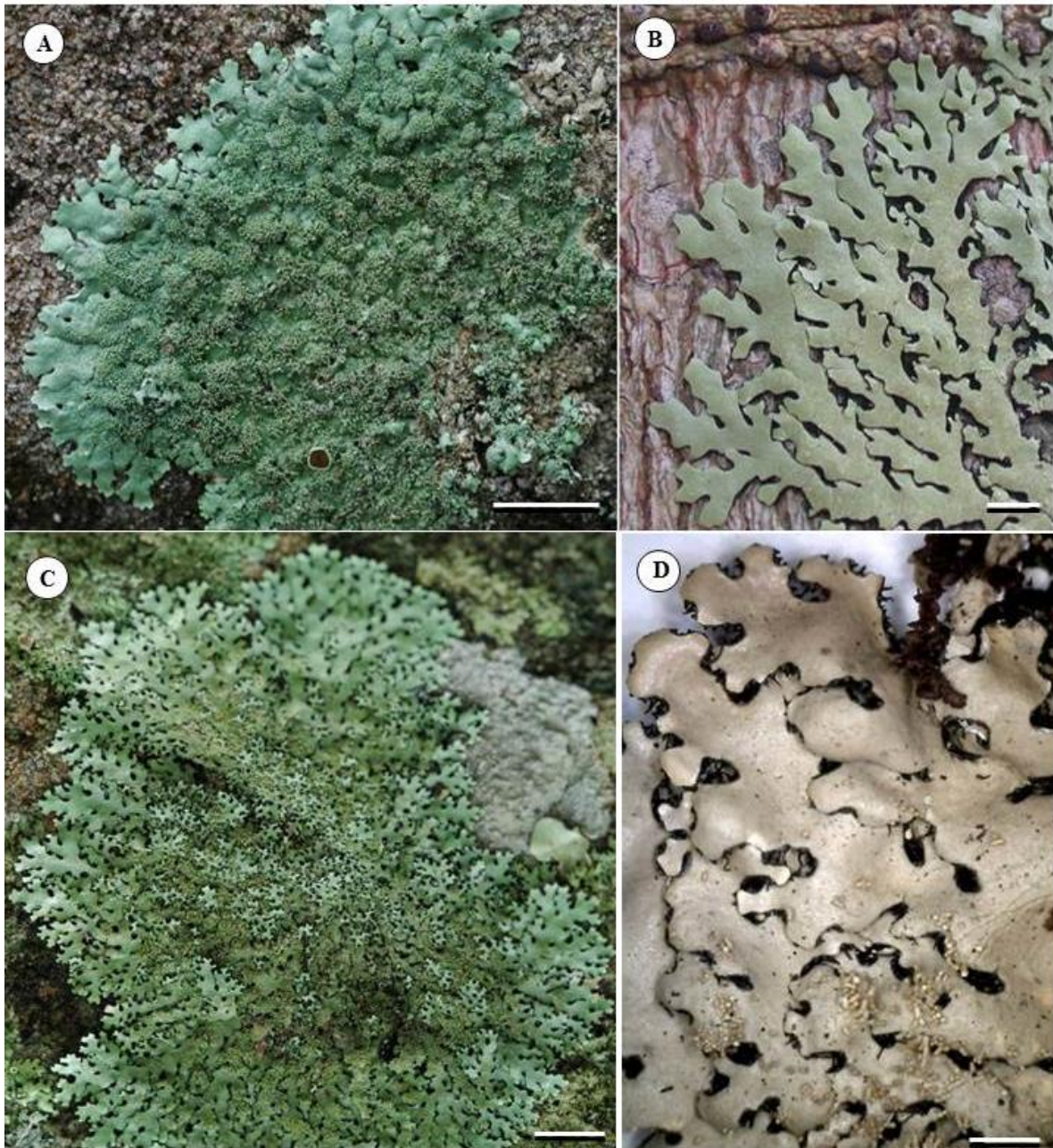
Conidia were bifusiform. *Relicina intertexta*, *R. malaccensis* and *R. rahengensis* belong to the genus *Relicina*, subgenus *Relicinopsis* (Elix & Verdon) Kirika, Divakar & Lumbsch that were characterized by thallus colors being yellowish green. Lobe shape, sublinear to subirregular with margins entire crenate or serrate, apice incised to truncate were found. Simple, furcate or agglutinate rhizine was developed from the lower cortex. The bitunicate ascus possessed hyaline, simple and ellipsoid ascospores. Conidia were fusiform to baciliform. Of the 12 taxa, ten major substances were found and usnic acid was a common chemical substance present on the upper cortex (Table 1).

Key to species of *Relicina* in Thailand.

1a.	Lobes with marginal bulbate cilia .....	2
1b.	Lobes without cilia .....	10
2a.	Thallus isidiate, isidiate-lobulate, or lobulated .....	3
2b.	Thallus lacking isidia and lobules .....	6
3a.	Isidia becoming dorsiventral and lobulated .....	<i>R. palmata</i>
3b.	Isidia distinct, cylindrical .....	4
4a.	Lower surface pale brown; rhizine densely branched .....	<i>R. circumnodata</i>
4b.	Lower surface black .....	5
5a.	Norstictic acid present ... ..	<i>R. abstrusa</i>
5b.	Echinocarpic acid present ... ..	<i>R. planiuscula</i>
6a.	Lower surface tan to pale brown; protocetraric acid present ... ..	<i>R. sublanea</i>
6b.	Lower surface black .....	7
7a.	Medulla K - .....	<i>R. subconivens</i>
7b.	Medulla K+ red .....	8
8a.	Medulla P+ orange red; succinprotocetraric acid present .....	<i>R. sublimbata</i>
8b.	Medulla P+ orange red; norstictic acid present .....	9
9a.	Apothecia ecoronate ... ..	<i>R. polycarpa</i>
9b.	Apothecia coronate .....	<i>R. subabtrusa</i>
10a.	Thallus without isidia .....	<i>R. intertexta</i>
10b.	Thallus with isidia .....	13
11a.	Medulla P+ red .....	<i>R. malaccensis</i>
11b.	Medulla P- .....	<i>R. rahengensis</i>

**Table 1.** Lichen substances found among species of the genus *Relicina*.

Lichen substance	Scientific name
Upper cortex	
Usnic acid	<i>Relicina abstrusa</i> , <i>R. circumnodata</i> , <i>R. intertexta</i> , <i>R. malaccensis</i> , <i>R. palmata</i> , <i>R. planiuscula</i> , <i>R. polycarpa</i> , <i>R. rahengensis</i> , <i>R. subabstrusa</i> , <i>R. subconnivens</i> , <i>R. sublanea</i> and <i>R. sublimbata</i>
Medulla layer	
4-O-demethylbarbatic acid	<i>Relicina rahengensis</i>
barbatic acid	<i>Relicina rahengensis</i>
caperatic acid	<i>Relicina subconnivens</i>
echinocarpic acid	<i>Relicina planiuscula</i> , <i>R. palmata</i> and <i>R. polycarpa</i>
fumarprotocetraric acid	<i>Relicina sublimbata</i>
hyposalazinic acid	<i>Relicina abstrusa</i>
norstictic acid	<i>Relicina abstrusa</i> , <i>R. polycarpa</i> and <i>R. subabstrusa</i>
protocetraric acid	<i>Relicina intertexta</i> , <i>R. malaccensis</i> , <i>R. circumnodata</i> and <i>R. sublanea</i>
succinprotocetraric acid	<i>Relicina sublimbata</i>



**Figure 1.**

Characteristics of the genus *Relicina* (Hale & Kurok.) Hale: Firmly adnate thallus of suborbicular in outline, B. Lobe linear, subdichotomously branched, C. Crenate margins of subirregular outline colony, D. Laminal isidia and marginal bulbate cilia

(bars: A = 1 cm; B = 1 mm; C = 1 cm; D = 1.5 mm).

### Conclusion:

Twelve species of *Relicina* were reported in Thailand. They were characterized by having yellowish green thalli. Lobe shape, sublinear to subirregular with margins entire crenate or serrate with bulbate cilia (*Relicina abstrusa*, *R. circumnodata*, *R. palmata*, *R. planiuscula*, *R. polycarpa*, *R. subabstrusa*, *R. subconnivens*, *R. sublanaea*, *R. sublimbata*) or eciliate (*Relicina intertexta*, *R. malaccensis* and *R. rahengensis*), and apices incised to truncate were found. Simple, furcate or agglutinate rhizine, was developed from the lower cortex. The bitunicate ascus contained hyaline, simple and ellipsoid ascospores. Conidia were bifusiform. Usnic acid was a chemical substance found on the upper cortex. Medullary substances included 4-O-demethylbarbatic acid, barbatic acid, caperatic acid, echinocarpic acid, fumarprotocetraric acid, hyposalazinic acid, norstictic acid, protocetraric acid and succinprotocetraric acid.

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