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NOTE

Saxicolous species of the lichenized fungal genus *Porina* (Ascomycota; Porinaceae) new records and a key to species in Thailand

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ABSTRACT: Species of the genus *Porina* can growth on various substrates, including siliceous rocks. This study focus on saxicolous species, including two new records for Thailand; *P. leptalea* and *P. nucula*. Ten species of *Porina* were found in Thailand and a key to the identification of the species is provided.

KEY WORDS: Asia, *Porina bellendenica, Porina guentheri, Porina leptalea, Porina mastoidea*, *Porina nucula*, *Saxicolous*.

INTRODUCTION

The genus *Porina* belongs to the family Porinaceae occurring worldwide, but with a center of diversity in tropical rainforest regions. Species of the genus can grow on different substrates such as rock, bark and leaves (Lücking, 1996; 2004; 2008; Lücking and Malcolm, 1997; Lücking and Vezda, 1998; McCarthy, 1993, 1994, 1999, 2003, 2013; McCarthy and Kantavilas, 1993; McCarthy and Malcolm, 1997; Vongshewarat *et al*., 1999; Santesson, 1952). Saxicolous species of *Porina* are known from numerous localities in both hemipheres (McCarthy, 1993, 1999; Vongshewarat *et al*., 1999). In Thailand eight saxicolous *Porina* species were reported (Aptroot *et al*., 2007, Buaruang *et al*., 2017; Boonpragob *et al*., 1998; McCarthy 1999; Wolseley *et al*., 2002). In our study we found two additional species not previously recorded from Thailand and a key to the identification of saxicolous species occurring in Thailand is provided.

MATERIALS AND METHODS

This study is mainly based on new collections made by the first author deposited in MSUT and F. Sections of thalli and perithecia were cut using a razor blade and examined in water, a solution of KOH, and Lugol's solution using a ZEISS Axioscope 2 plus compound microscope. Measurements of algae, thalli hyphae, paraphyses, involucrellum, exciple and ascospores were made at by 400 and by 1000 magnifications. Chromatography (HPTLC) was performed with the standard solvent systems A and C (Culberson 1972; Arup *et al.,* 1993).

RESULTS AND DISCUSSION

Two species of *Porina* are new records for Thailand; *P. leptalea* and *P. nucula*. *Porina leptalea* is distinguished by having 3-septate ascospores and dull orange-brown to red brown perithecia. *Porina nucula* is rarely found on rocks and can be recognized by its 9-septate, 65–70 µm long ascospores. Saxicolous species occurring in Thailand can be identified using the following key.

Key to the species of genus *Porina* in Thailand

1a. Ascospores muriform, narrowly ellipsoid to fusiform, 45 by 80 µm long ……..… 2. ***P. eminentior***
1b. Ascospores transversely septate ……...……. **2**
2a. Ascospores 3-septate ……..…….. **3**
2b. Ascospores 5–15-septate ……..…….…… **4**
3a. Perithecia hemispherical to subglobose, 0.15–0.25 mm diam., dull orange-brown to red brown ……..……..…... 5. ***P. leptalea***
3b. Perithecia 0.25–0.35 mm diam., greenish black …… 8. ***P. siamensis***
4a. Ascospores 5–9-septate ……..……..…….. **5**
4b. Ascospores 15-septate, 32–56 µm long, perithecia in verrucae ……..…… 1. ***P. bellendenica***
5a. Ascospores 5–7-septate, 22–70 µm long ……**6**
5b. Ascospores 9-septate, 32–83 by 10–18 µm, perithecia immersed in hemispherical to subglobose ……..……..…… 7. ***P. nucula***
6a. Ascospores 6.5–20 µm wide ……..……..…… **7**
6b. Ascospores 3.5–7.5 µm wide ……..…. **8**
7a. Ascospores 50–70 µm long with thick gelatinous sheath …….. …….. 6. ***P. mastoidea***
7b. Ascospores 28–56 µm long without gelatinous sheath …….. …… 10. ***P. wolseleyae***
8a. Perithecia 0.4–0.8 mm diam, verrucae convex to hemispherical, thallus rimose to areolate with isidioid structures ….. 9. ***P. tetracerae***
8b. Perithecia 0.2–0.4 mm diam., hemispherical to subglobose, thallus without isidia ……..…… **9**
9a. Perithecia semi–immersed, concolorous with or paler than the perithecial apex ……..… 4. ***P. kansriae***
9b. Perithecia superficial, black, apex round, exposed perithecia …….. ……..…… 3. ***P. guentheri***

TAXONOMIC TREATMENT

1. *Porina bellendenica* Müll.Arg., Hedwigia 30: 56 (1891) **Figs. 1A–B**

A description of this species is found in Wolseley *et al*., (2002).

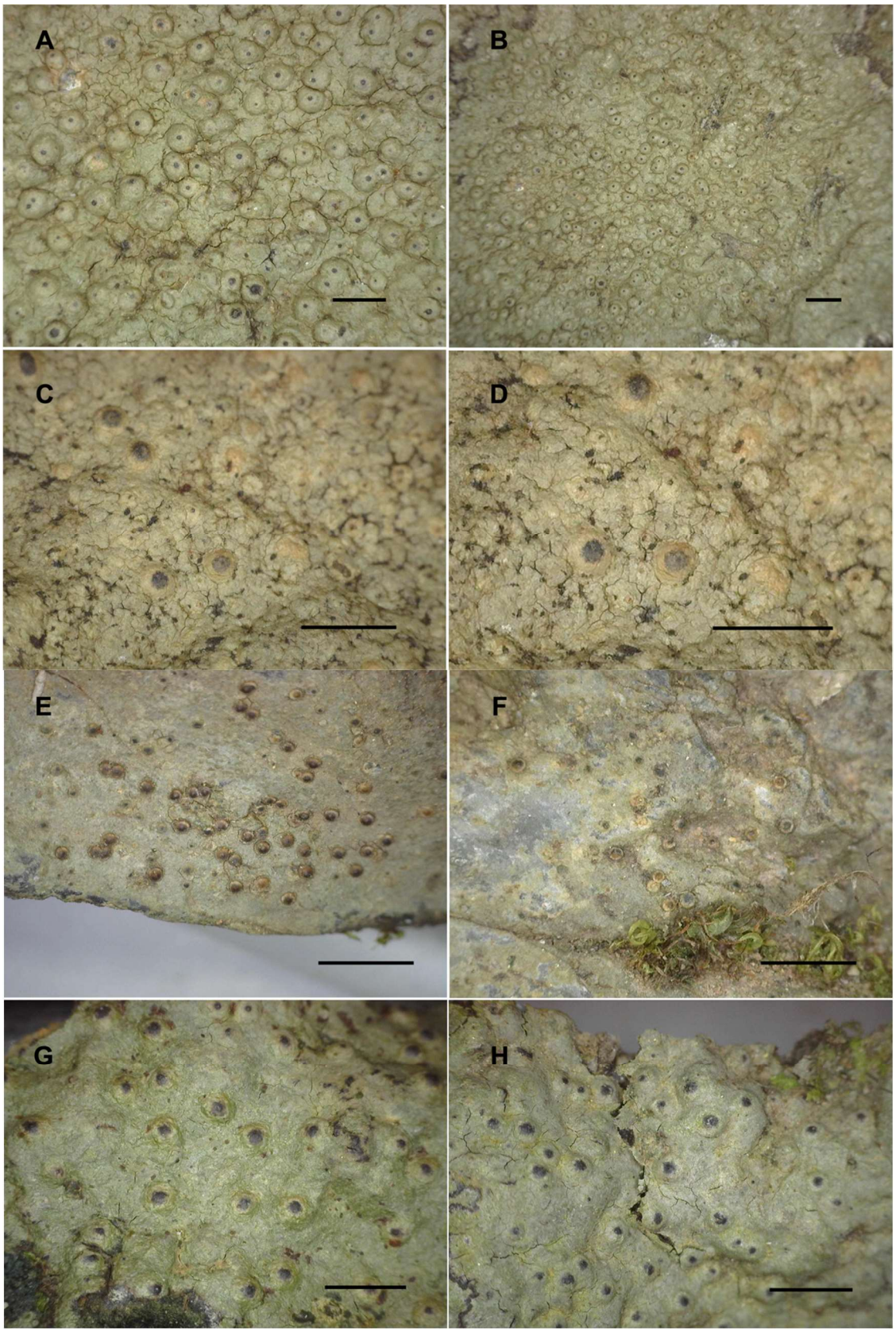

Fig. 1. Morphology of saxicolous ***Porina*** in Thailand. **A** and **B**: ***Porina bellendenica***, **C** and **D**: ***Porina guentheri,*** **E**. and **F**: ***Porina leptalea***, **G** and **H**: ***Porina mastoidea,*** scale bar = 1 mm.

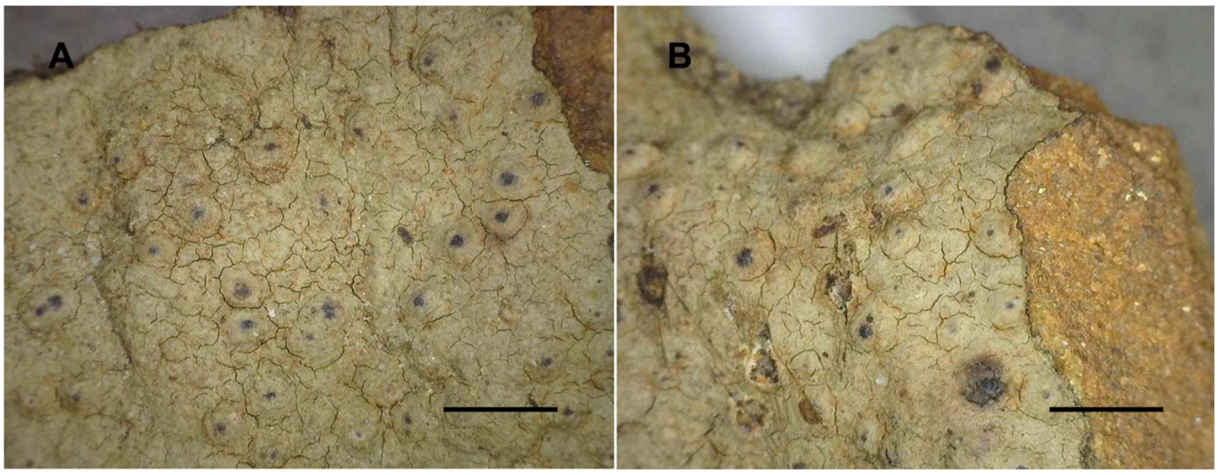

Fig. 2. Morphology of saxicolous ***Porina*** in Thailand. **A** and **B**: ***Porina nucula***, scale bar = 1 mm.

Secondary chemistry: No lichen substance detected by HPTLC.

Distribution: Found only once in a dry evergreen forest, at 191 m.

Specimen examined. **Thailand. Uttaradit Province,** Lablae district, Mae Phun waterfall, 17°43′51″N, 99°58′38″E, dry evergreen forest, on sandstone, 14 Jun. 2016, *Naksuwankul 11990* (MSUT).

2. *Porina eminentior* (Nyl.) P.M.McCarthy, Lichenologist 32: 42 (2000)

Descriptions can be found in Wolseley *et al*., (2002) and Aptroot *et al*., (2007).

3. *Porina guentheri* (Flot.) Zahlbr., Cat. Lich. Univ. 1: 384 (1922)

Figs. 1C–D

A description was provided by Aptroot *et al*., 2007.

Secondary chemistry: No lichen substance detected by HPTLC.

Distribution: Found in a lower montane rainforest, at 1,365 m.

Specimen examined. **Thailand. Loei Province,** Phu Rua district, Phu Rua National Park, natural trail, 17°51′39″N, 101°39′64″E, Alt. 1,365 m, lower montane rainforest, 14 Jun. 2016, *Naksuwankul 10039* (MSUT).

4. *Porina kansriae* P.M. McCarthy, Lichenologist 31: 239 (1999)

A description was given by McCarthy 1999.

5. *Porina leptalea* (Durieu & Mont.) A.L.Sm., J.M.Crombie & A.L.Smith, *Monogr. Brit. Lich*. 2: 333 (1911).

Figs. 1E–F

Ascospores 3-septate, 17.5–25 by 3.75–5 µm, without gelatinous sheath, perithecia hemispherical to subglobose, 0.15–0.25 mm diam., dull orange-brown to orange-red brown, exposed perithecia.

Secondary chemistry: No lichen substance detected by HPTLC.

Distribution: Dry evergreen forest and lower montane rainforests, between 840 and 1,830 m.

Specimens examined. **Thailand. Phrae Province,** Muang district, Tat Mok National Park, Tat Mok waterfall (Mae Khaem waterfall), 18°33′N, 100°28′E, Alt. 840 m, dry evergreen forest, on sandstone, 18 Jun. 2016, *Naksuwankul 12001* (MSUT). Nan Province: Pua district, Doi Phu Kha National Park, Silaphet waterfall, 19°19′79″N, 101°08′13″E, Alt. 1,830 m, lower montane rainforest, on sandstone, 15 Jun. 2016, *Naksuwankul 12020* (MSUT).

6. *Porina mastoidea* Fée, Essai Crypt. Écorc. (Paris): 82 (1825) [1824].

Figs. 1G–H

A description can be found in Wolseley and Aguirre–Hudson 1997a, 1997b; Boonpragob *et al*., 1998; and Wolseley *et al*., 2002.

Secondary chemistry: No lichen substance detected by HPTLC.

Distribution: Dry evergreen forest, between 450 and 1,202 m.

Specimens examined. **Thailand. Phitsanulok Province,** Nakhon Thai district, Romklao-Pharadon waterfall, 16°59′49″N, 101°1′44″E, Alt. 1,202 m, lower montane rainforest, on sandstone, 8 Oct. 2016, *Naksuwankul 11980* (MSUT). Loei Province: Phu Rua district, Phu Rua National Park, natural trail, 17°51′39″N, 101°39′64″E, Alt. 1,365 m, lower montane rainforest, on sandstone rock, 14 Jun. 2016, *Naksuwankul 10033* (MSUT). Si Sa Ket Province: Khantharalak district, Khao Phra Wihan National Park, natural trail to Phu La Or waterfall, 14°77′98″N, 101°61′21″E, Alt. 450 m, dry evergreen forest, on sandstone rock, 8 Jun. 2016, *Naksuwankul 10074* (MSUT), *Naksuwankul 10075* (F), *Naksuwankul 10082-10086* (MSUT).

7. *Porina nucula* Ach. Syn. Meth. Lich. 112 (1814).

Figs. 2A–B

Ascospores 7(9)-septate, 65–70 by 12.5–20 µm, without gelatinous sheath, perithecia hemispherical to wart-shaped, prominent perithecia lacking or with a small darkened spot around the ostiole.

Secondary chemistry: No lichen substance detected by HPTLC.

Distribution: Dry evergreen forest and lower montane rainforest, between 450 and 1,365 m.

Specimens examined. **Thailand. Loei Province,** Phu Rua district, Phu Rua National Park, natural trail, 17°51′39″N, 101°39′64″E, Alt. 1,365 m, lower montane rainforest, on sandstone, 14 Jun. 2016, *Naksuwankul 10031* (MSUT), *Naksuwankul 10035* (F). Si Sa Ket Province: Khantharalak district, Khao Phra Wihan National Park, natural trail to Phu La Or waterfall, 14°77′98″N, 101°61′21″E, Alt. 450 m, dry evergreen forest, on sandstone , 8 Jun. 2016, *Naksuwankul 10080* (MSUT).

8. *Porina siamensis* P.M. McCarthy, Lichenologist 31: 242 (1999)

The description was provided by McCarthy 1999.

9. *Porina tetracerae* (Ach.) Müll.Arg., Bot. Jahrb. Syst. 6: 401 (1885)

A description of this species can be found in Boonpragob *et al*., (1998) and Wolseley *et al*., (2002).

10. *Porina wolseleyae* P.M. McCarthy, Lichenologist 31: 244 (1999)

For a description see McCarthy (1999).

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