

New records of pyrenocarpous lichens from the Philippines

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Abstract: Pyrenocarpous lichens are an important component of the forest ecosystem, yet remain understudied. Following the recent field surveys of the lichen biota in Mt. Musuan, four pyrenolichen species previously unreported from the Philippines were collected, namely: *Porina exocha*, *Pyrenula pyrenuloides*, *P. subsoluta*, and *Nigrovothelium inspersotropicum*. Each species is briefly described with morphology and chemistry, distribution, ecology, notes, and illustrations. These collections underscore the need for expanded research attention to fully catalogue the lichen diversity in the Philippines.

Keywords: Asia, Porinaceae, pyrenolichens, Pyrenulaceae, Trypetheliaceae

INTRODUCTION

Pyrenocarpous lichens colloquially known as pyrenolichens, are mainly crustose species unified by their tiny flask-shaped fruiting bodies (perithecia) embedded in the thalli with an opening pore (ostiole) at the apex (Richardson, 1970; Harris, 1973; Aptroot, 2012). There are over 4000 known species worldwide, comprising a significant assemblage within the tropical forest ecosystems.

The Philippines possesses unique geographical features, characterized by their archipelagic environment, in which they harbor diverse forest ecosystems, supporting lichens as pioneer colonizers on bark, leaves, and rocks. In a recent checklist compiled by Paguirigan et al. (2020), around 160 species of pyrenocarpous lichens have been reported in the Philippines, represented by 28 genera, nine families, nine orders, and three classes. These initial checklists suggest a richness which could prove exceptional once more research attention has been given (Vainio, 1921; Gruezo, 1979; Aptroot et al., 2012; Sipman et al., 2013; Bawingan et al., 2014). Here we recorded four additional pyrenocarpous lichen species new to the Philippines.

MATERIALS AND METHODS

Entry Protocol and Permits

Prior informed consent was obtained from Central Mindanao University regarding the entry to conduct the study at Mt. Musuan. Likewise, Gratuitous Permit No. R10: 2023-124 was secured from the Department of Environment and Natural Resources (DENR) Regional X office in compliance with Republic Act No. 9147 for the collection of the specimen.

Study Site

The present study was based on the collected specimens during a 2023 lichen survey in Mt. Musuan (Fig. 1). This area was characterized as a lowland secondary forest ecosystem in the province of Bukidnon, Southern Philippines. Although much of the surrounding landscape consists of cultivated agricultural areas and fragmented forest patches, Mt. Musuan remains an important habitat harboring a unique and diverse biotic assemblage (Amoroso et al., 2002).

Morphological and Chemical Examination

Specimens of pyrenolichens were examined using standard microscopy techniques. The morpho-anatomical characters – viz. thallus, perithecia, asci, hamathecium, number of

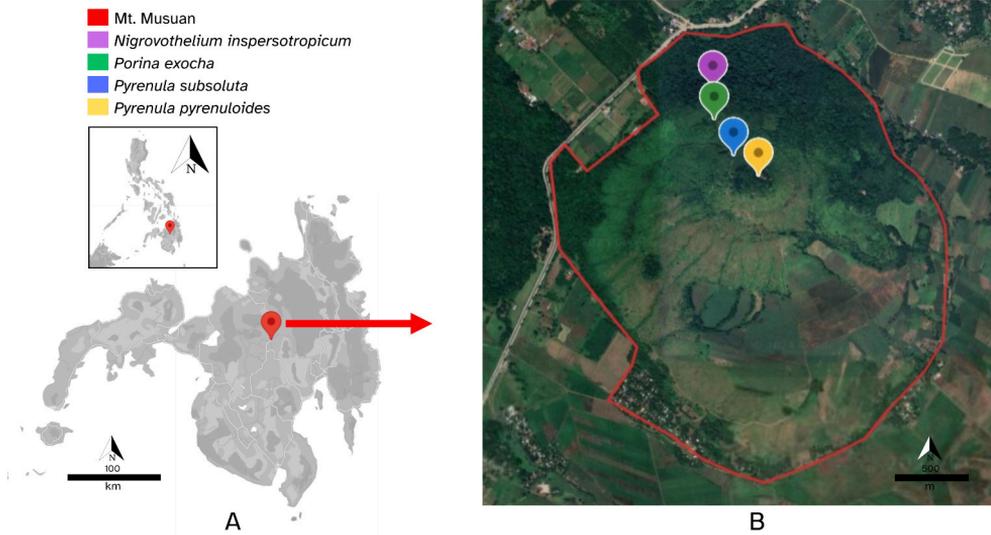


Fig 1. Location map where pyrenolichen species were collected. A – map of Mindanao Island. B – map of Mt. Musuan.

ascospores per ascus, size, and septation were examined and microphotographed using a stereoscope and an optical microscope. For measurement and illustration purposes, thin hand-cut sections of the specimens were mounted in water only. Afterward, the chemistry was investigated using a long-wave UV light and spot test using 10% KOH solution on sections and the thallus surface. Voucher specimens were dried and deposited in Central Mindanao University Herbarium (CMUH) in Bukidnon.

Lichen Identification

All of the specimens were confirmed up to species-level identities using the appropriate keys and literature (McCarthy, 2003; Aptroot et al., 2008; Aptroot, 2012; Aptroot, 2021). The nomenclature of the species follows the Index Fungorum (www.indexfungorum.org).

RESULTS

Taxonomy

Porinaceae

PORINA EXOCHA (Nyl.) P.M. McCarthy

(Figs. 2A, 3A–B)

Description: Corticolous. Thallus corticate, rimose to coarsely verrucose, olive-green to

yellowish green, prothallus whitish. Perithecia olive brown, hemispherical to globose, immersed from the substratum, apex slightly concave. Perithecial wall with raised tubercles 0.7–0.9 (–1.2) mm in diameter. Ostiole apical, inconspicuous with medium to dark brown peristomial area. Involucrellum pale yellowish brown. Ascospores 8 per ascus, fusiform-ellipsoid, colorless, muriform, $49\text{--}91 \times 19\text{--}27 \mu\text{m}$, with 21–32 transverse septa, each locules in c. ≤ 6 vertical series.

Chemistry: Thallus UV–, K+ red.

Distribution and ecology: Widespread in New Zealand. Also reported in Norfolk Island, Raratonga, Cook Islands and Northeastern Queensland (Galloway, 2007). This is the first report of *P. exocha* for the Philippines. In New Zealand, this taxon typically grows on the bark and rocks of forests and coastal areas. Meanwhile, in the Philippines, the species has been reported so far at one locality, in Mt. Musuan, growing on the bark of *Wendlandia luzoniensis*.

Specimen examined: Philippines, Bukidnon, Maramag, Mt. Musuan. $7^{\circ}52'47''$ N, $125^{\circ}04'03''$ E, 474 masl, mixed species forest, on the bark, 16 Mar 2023; ECT113 (CMUH).

Notes: The Philippine specimen agrees with the published description of *P. exocha* (McCarthy,

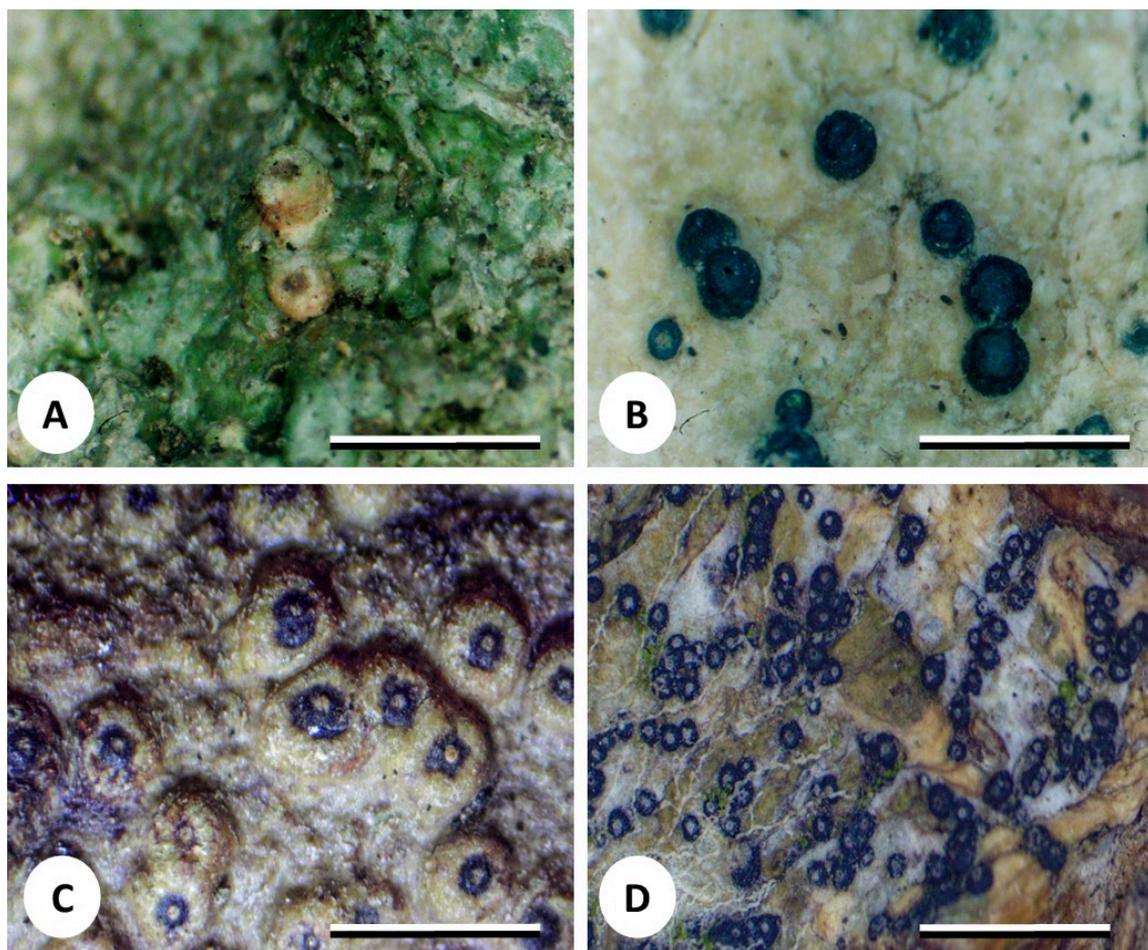


Fig. 2. Thallus with perithecia. A – *Porina exocha*. B – *Pyrenula pyrenuloides*. C – *P. subsoluta*. D – *Nigrothelium inspersionis*. Scale = 2 mm.

2000), and the ascospore measurements fit well within the size range $40\text{--}150 \times 22\text{--}40 \mu\text{m}$ of New Zealand descriptions where the taxon is considered as native and locally abundant (Galloway, 1985, 2007).

Pyrenulaceae

PYRENULA PYRENULOIDES (Mont.) R.C. Harris

(Figs. 2B, 3C–D)

Description: Corticolous. Thallus corticate, smooth, pale olive-green to brownish, with pseudocyphellae. Perithecia black, subglobose simple, solitary, immersed from the substratum, c. 0.5–1.0 mm in diameter. Perithecial wall with crystals $<200 \mu\text{m}$ thick. Ostiole apical, pale.

Hamathecium not interspersed with oil droplets. Ascospores 4–8/ascus, uniseriate to irregularly biseriata, muriform, with c. 7–10 rows of c. 3–8 locules, fusiform with rounded ends, grey-brown, $32\text{--}65 \times 19\text{--}24 \mu\text{m}$. Lumina rounded to somewhat angular.

Chemistry: Thallus UV–, K–.

Distribution and ecology: Pantropical and subtropical. Aptroot (2009) reported this species to inhabit open, coastal vegetation. In contrast, the Philippine material has been found in two phorophytes, *Gmelina arborea* and *G. elliptica*, both of which were planted on the peak of Mt. Musuan, Bukidnon, Philippines. This is the first report of *P. pyrenuloides* for the Philippines.

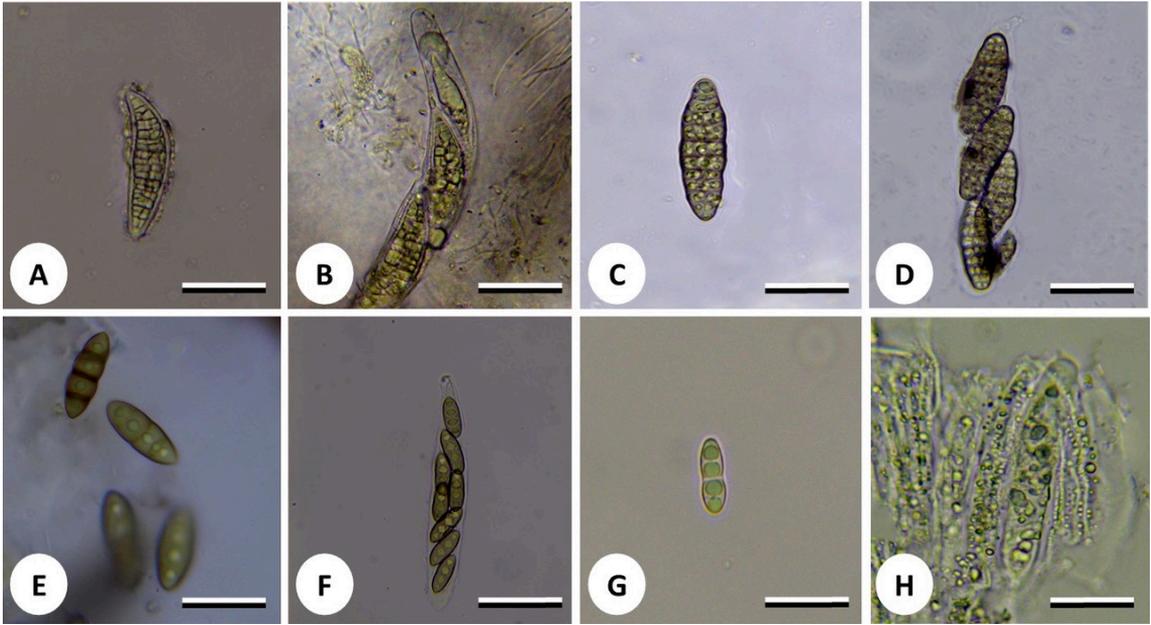


Fig. 3. Ascospores and asci types of pyrenocarpous lichens new to the Philippines. A – *Porina exocha*: muriform ascospores. B – *P. exocha*: ascus with apical thickening. C – *Pyrenula pyrenuloides*: muriform ascospores with central locules. D – *P. pyrenuloides*: asci uniseriate. E – *P. subsoluta*: ascospores 3-distoseptate. F – *P. subsoluta*: asci uniseriate; G – *Nigrovothelium inspersotropicum*: ascospores 3-septate. H – *N. inspersotropicum*: asci surrounded with oil droplets. Scales A–E, G = 15 μm ; F, H = 10 μm .

Specimen examined: Philippines, Bukidnon, Maramag, Mt. Musuan. 7°52'36" N, 125°04'10" E, 603 masl, Mt. Musuan built-up peak/summit, on the bark, 17 Mar 2023; ECT108 (CMUH).

Notes: The Philippine specimen agrees with the description cited in the protologue (Harris, 1989). This taxon is superficially similar to *P. leucostoma* but differs by having more than 6 central locules, and lumina are mostly rounded (Aptroot, 2012). *Pyrenula pyrenuloides* also resembles *P. papillifera*, but the latter differs by its ascospores with pointed ends (Aptroot, 2021).

PYRENULA SUBSOLUTA (Müll. Arg.) Aptroot

(Figs. 2C, 3E–F)

Description: Corticolous. Thallus thinly corticate, olive-brown. Perithecia brown, conical to hemispherical, irregularly-rounded, melanothecoid stromata, sessile from the substratum. Perithecial wall clypeate. Ostiole apical, olive-brown, slightly raised. Hamathecium not inspersed. Ascospores 8 per ascus, grey-brown,

3-distoseptate, 25–34 \times 12–13 μm . Lumina diamond-shaped.

Chemistry: Thallus UV+ yellow, K–.

Distribution and ecology: Costa Rica (Aptroot et al., 2008). This is the first report of *P. subsoluta* for the Philippines and the first outside the type country. This taxon was found on the bark of *Rhus taitensis*, planted beside the established trail of Mt. Musuan.

Specimen examined: Philippines, Bukidnon, Maramag, Mt. Musuan. 7°52'40" N, 125°04'06" E, 536 masl, plantation forests near the established trail, on the bark, 16 Mar 2023; ECT43 (CMUH).

Notes: The ascospore length of the Philippine specimen is slightly longer than the measurements provided in the basionym protologue, 28–32 μm (Müller, 1891). *Pyrenula subsoluta* is similar to another melanothecoid species, *P. anomala*, but with larger ascospores (Aptroot et al., 2008).

Trypetheliaceae

NIGROVOTHELIUM INSPERSOTROPICUM Aptroot & Diederich

(Figs. 2D, 3G–H)

Description: Corticolous. Thallus corticate, smooth to suborbicular, olive-green to pale brown, prothallus blackish $\leq 200 \mu\text{m}$ thick. Perithecia black, simple, solitary to aggregated, superficial from the substratum. Perithecial wall entire, carbonized, up to $60 \mu\text{m}$ thick laterally. Ostiole apical, surrounded by a brownish ring. Hamathecium heavily inspersed with oil globules. Ascospores 8 per ascus, 3-septate, fusiform to oblong-ellipsoid, hyaline, $15\text{--}28 \times 6\text{--}7 \mu\text{m}$.

Chemistry: Thallus UV–, K–.

Distribution and ecology: Guyana and Seychelles (Diederich et al., 2017), India (Ram & Jagadeesh 2022). First report of *N. inspersotropicum* for the Philippines. This taxon was noted only from the bark of *Senna siamea*, within the shady understory vegetation of Mt. Musuan, Bukidnon.

Specimen examined: Philippines, Bukidnon, Maramag, Mt. Musuan. $7^{\circ}52'53''$ N, $125^{\circ}04'03''$ E, 445 masl, Thailand Acacia plantation, on the bark, 17 Mar 2023; ECT179 (CMUH).

Notes: The Philippine specimen matches with all the characters cited in the published protologue of *N. inspersotropicum* (Diederich et al., 2017), except that the ascospores are slightly longer. This taxon resembles *N. tropicum* but only differs by its heavily inspersed hamathecium with oil globules.

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DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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