

# A new species of *Agonimia* (Ascomycota, Eurotiomycetes, Verrucariaceae) from Morane atoll (Tuāmotu-Gambier Islands, French Polynesia)

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**Abstract.** *Agonimia gargominyi* (Verrucariaceae, Verrucariales) is described and illustrated from bark samples collected from Morane atoll (Tuāmotu-Gambier Islands, French Polynesia). It is characterized by the large superficial perithecia having a pale brown-colored ostiolar region, the 8-spored asci, and the relatively large lobed squamules. Micromorphology of the ascomata and the thalline squamules matches the genus *Agonimia*. Additionally, to accommodate the inclusion of this newly identified species, the existing comprehensive key encompassing all known *Agonimia* species worldwide has been modified and updated accordingly. Detailed illustrations supplement the description of *Agonimia gargominyi*.

**Key words:** coral reefs, corticolous, lichen, Low Islands, Pacific Ocean, tropics

## Introduction

The genus *Agonimia* Zahlbr., which belongs to the family Verrucariaceae, order Verrucariales (Eurotiomycetes), was first described over a century ago by Zahlbruckner (1909) and displays a worldwide distribution (Breuss 2020; GBIF Secretariat 2023a). The genus is characterized by crustose to squamulose (sometimes foliose) thalli with a paraplectenchymatous structure, and in many species the cortical cells are papillate. The perithecia, which are not present in all species, are typically barrel-shaped or globose to ovoid, with a more or less distinctly three-layered wall, and without involucrellum. The asci are 1- to 8-spored, and the ascospores are muriform, ranging from hyaline to pale brown (Sérusiaux et al. 1999; Hafellner 2014; Breuss 2020). In November 2019, field surveys focusing on tracheophytes, bryophytes, and lichens species were performed on Morane atoll (Tuāmotu-Gambier Islands, French Polynesia). These investigations contributed to filling the knowledge gap on

the biodiversity of the uninhabited remote atoll (Meyer & Poncet 2021). As a result of these surveys, a lichenized corticolous ascomycete was collected, which could not be identified using existing literature. However, this specimen displayed resemblances to the genus *Agonimia*, an observation confirmed through meticulous morphological analyses, ultimately leading to the characterization of a novel species.

## Material and methods

### Surveyed territory and sampling methodology

Morane is a small and remote atoll located in the South Pacific Ocean (23°09'20"S, 137°08'00"W) with an emerged area of approximately 224 ha (Andréfouët & Chauvin 2005) that belongs to the Tuāmotu archipelago, but is administratively attached to the Gambier archipelago in French Polynesia (Fig. 1). The three nearest islands to Morane are Maria atoll, located about 160 km to the northeast, Fangataufa atoll approximately 190 km to the northwest, and the high volcanic island of Mangareva roughly 200 km to the east. Currently uninhabited, Morane atoll was home to 10 to 20 inhabitants between 1850 and 1884 (Emory 1939). It can be considered as a relatively intact atoll ecosystem, with a vascular flora composed of 21 native species and only one alien plant, the coconut (Meyer & Poncet 2021). In terms of climate classification, Morane falls under the 'Aw'

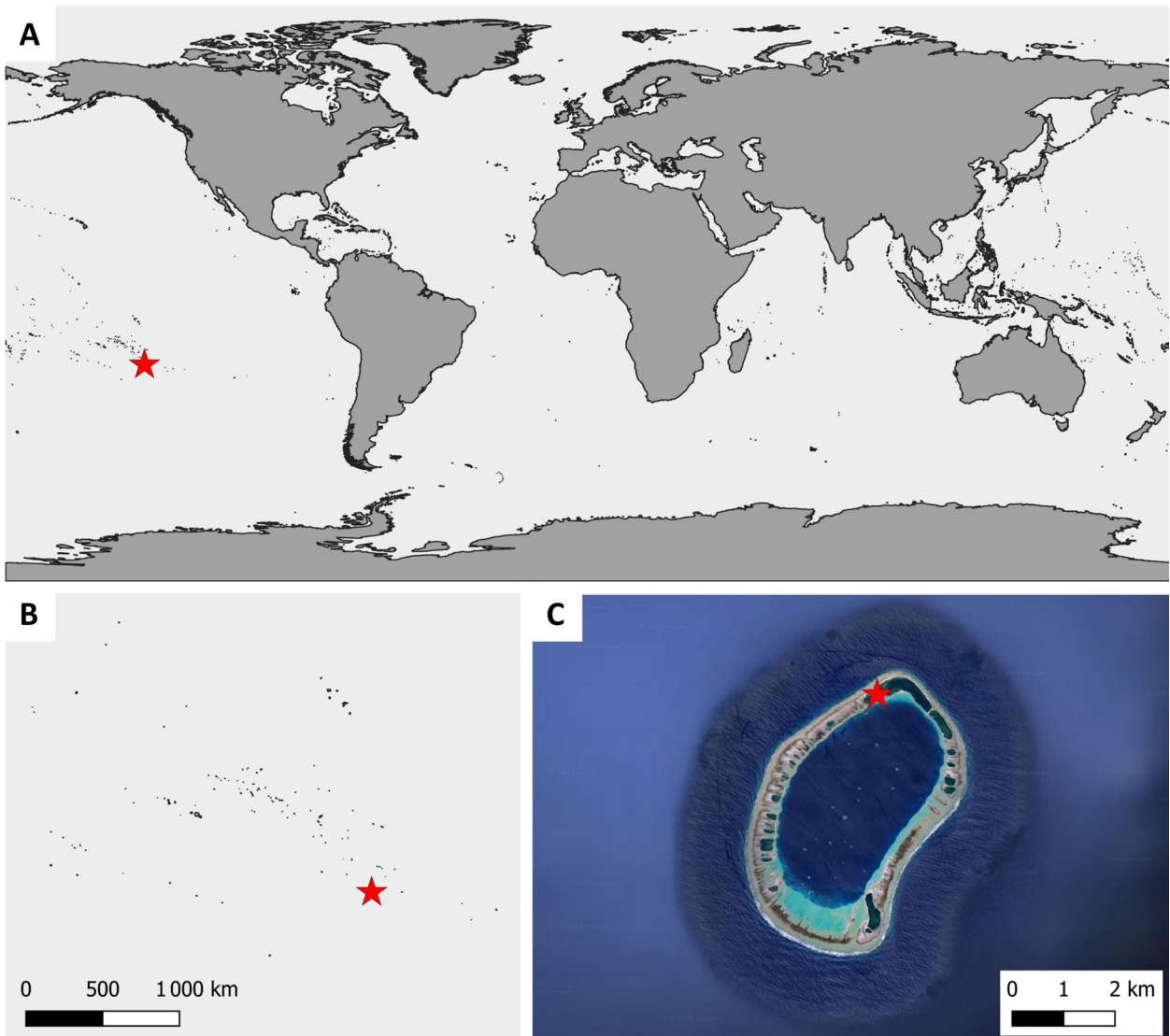
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**Figure 1.** Map of surveyed location. A – global location of Morane (red star); B – location of Morane (red star) within French Polynesia; C – satellite view of Morane and location of the sampled species (red star) (source Google satellite).

category based on the Köppen-Geiger climate classification system (Beck et al. 2018), indicating a tropical rainforest climate with consistent precipitation throughout the year. During a multidisciplinary scientific expedition conducted from November 6 to 11, 2019, opportunistic surveys of lichenized fungi were carried out. Samples collected during these surveys were preserved in dry paper envelopes and labeled with ecological information (including identification of phorophytes when applicable), as well as the date, and location obtained from a field GPS device.

### Species identification and description

Identification and descriptive work were performed using a Zeiss Stemi SV8 stereomicroscope and a Leitz Orthoplan compound microscope with phase contrast, connected to a Sony E3CMOS camera sensor. Sections were mounted in tap water, from which all measurements were taken. Measurements indicate the minimum and maximum values. Chemical spot reactions have been tested on the structures present in the fungus. They are abbreviated as

K (10% KOH), C (commercial bleach), KC (K followed by C), P (paraphenylenediamine), I (Lugol's reagent), KI (K followed by I), while UV refers to fluorescence at 366 nm. A “–” indicates a lack of reaction and a “+” indicates a positive reaction followed by information on the reaction.

### Results

#### Taxonomy

*Agonimia gargominyi* R. Poncet & J.-Y. Mey., sp. nov.  
(Figs 2–5)

Mycobank MB 851455

**Diagnosis:** The species is quite unique compared to currently known species of the genus, the perithecia are morphologically close to *Agonimia repleta* Czarnota & Coppins, but larger and superficial, the thallus squamules are larger and often lobed, and the ascospores are slightly bigger.

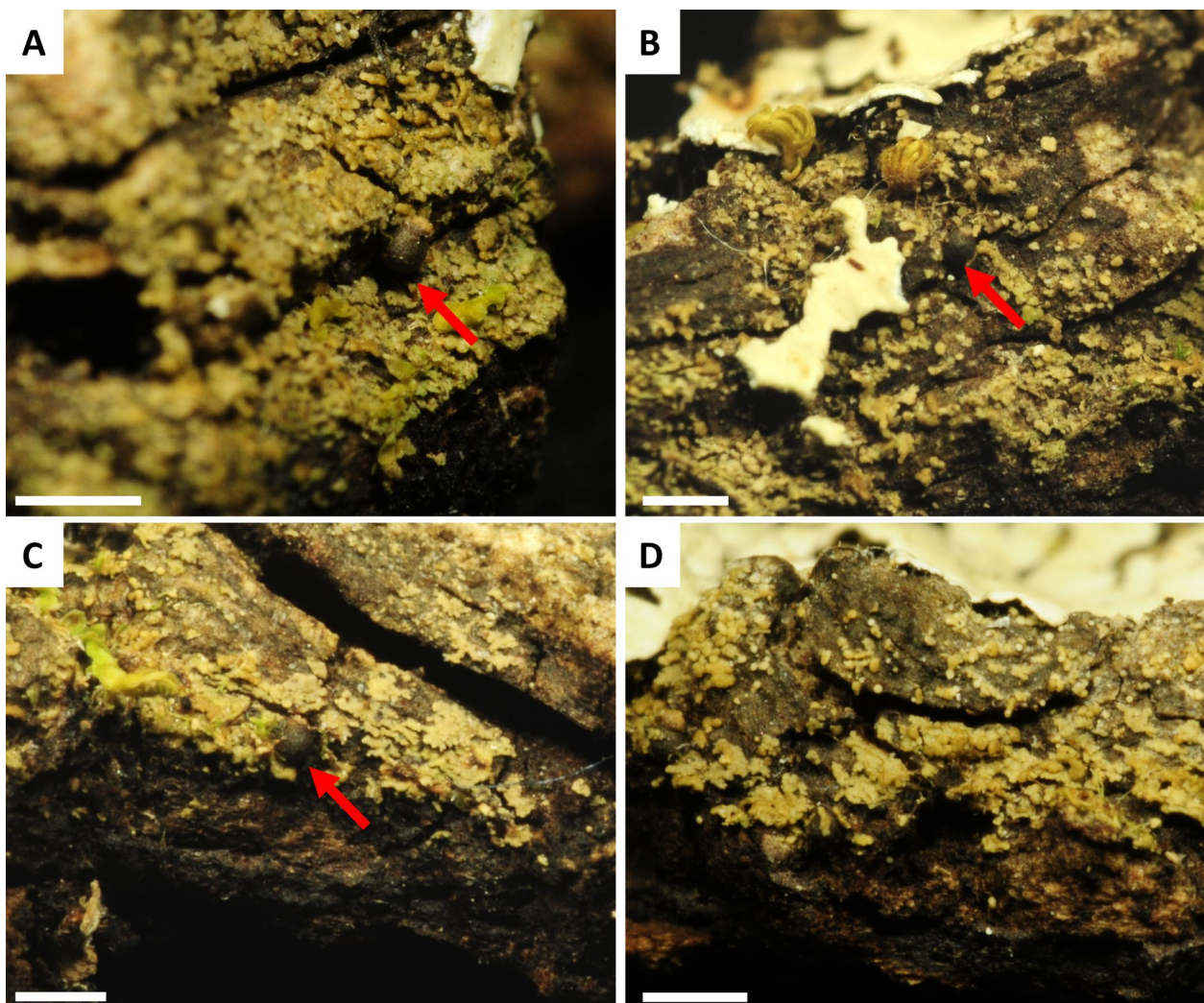
**Type:** Morane, 23°08'5.568"S, 137°07'35.508"W, 3 m a.s.l., corticolous on old branches of *Guettarda speciosa*, leg. J.-Y. Meyer, 6 November 2019, (MNHN-PC-PC0779835 – holotype).

**Description.** Thallus discrete, 0.5–1.5 cm diam., continuous or discontinuous, minutely squamulose, pale brown to white-cream when dry, translucent to slightly creamy when wet. Squamules convex 0.5–1.1 mm diam. (often lobed), frequently evolving to elongated finger-like squamules of 0.4–1 mm in length; cortex hyaline, single-layered, of thin-walled squared-rounded cells of 5–10  $\mu\text{m}$  diam., bearing papillae of 1–4  $\mu\text{m}$  height. Prothallus absent. Photobiont chlorococcoid, cells subspherical to globose, 6–10  $\mu\text{m}$  diam. Perithecia not abundant, barrel-shaped (to sub-pyriform), with a well-defined neck (faintly longitudinally furrowed), 0.35–0.40 mm wide, and 0.45–0.5 mm high, superficial, dark brown throughout except at the apex which is covered with a pale brown layer of cells (30–40  $\mu\text{m}$  high in section), surface matt and slightly irregular. Involucrellum absent. Ostiolum dark brown, 100–130  $\mu\text{m}$  diam. Excipulum 55–75  $\mu\text{m}$  wide, 3-layered, innermost layer prosoplectenchymatous, 25–35  $\mu\text{m}$  thick, hyaline; intermediate layer dark brown pigmented, paraplectenchymatous, 40–50  $\mu\text{m}$  thick; external layer hyaline, paraplectenchymatous, 3–5  $\mu\text{m}$  thick. Subhymenium concave, pale, up to 10  $\mu\text{m}$  tall. Hamathecium of long periphyses, 25–45  $\times$  1.7–2.2  $\mu\text{m}$ , 3–4 celled

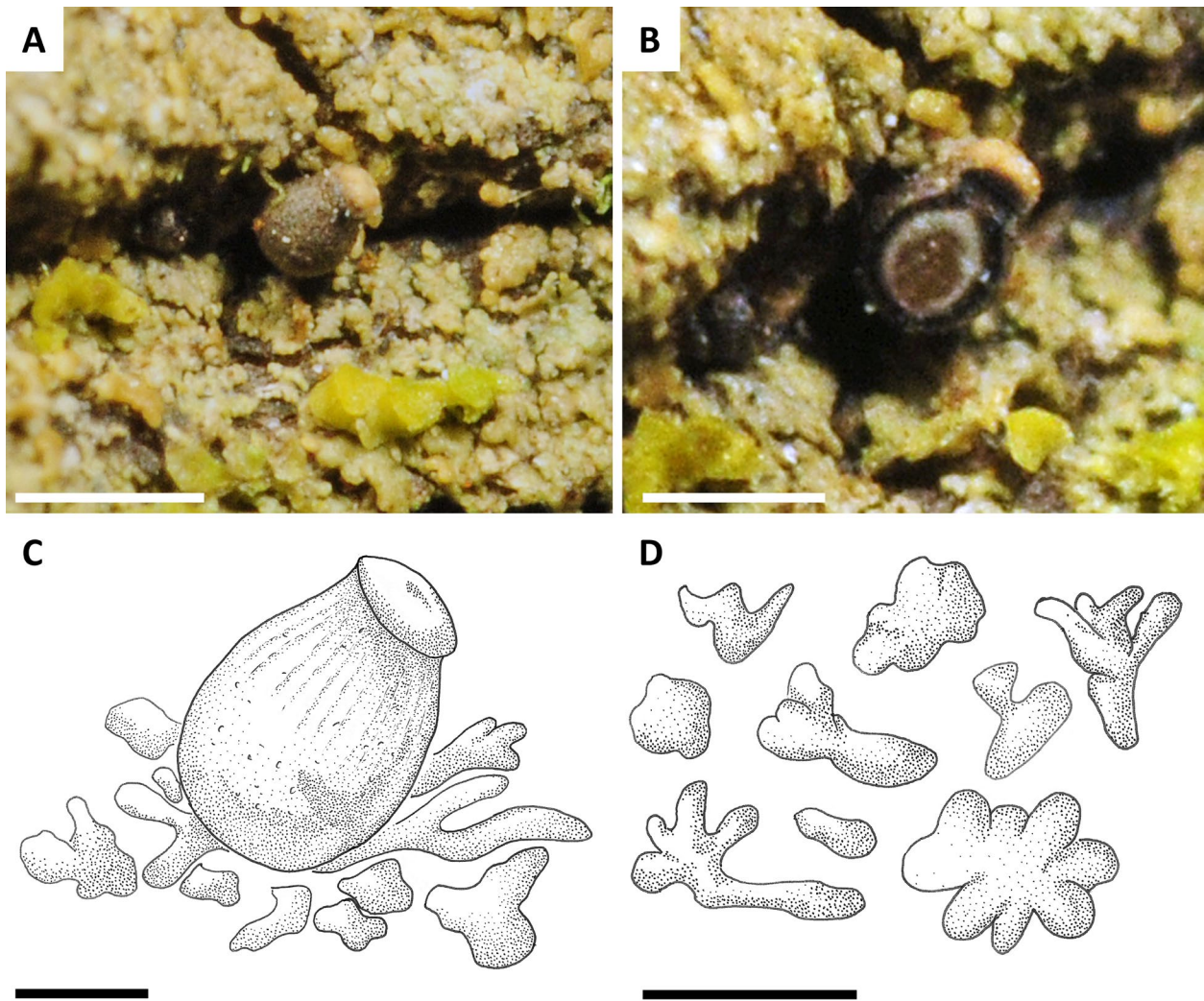
(more septate close to ostiolum), rounded at the ends; hymenial gel hemiamyloid, I+ wine, KI+ blueish. Asci 8-spored, 150–180  $\times$  38–75  $\mu\text{m}$ , clavate, verrucarialean fissitunicate, I–, KI–. Ascospores 37–48  $\times$  17–21  $\mu\text{m}$ , hyaline, muriform, 40–60 cells visible in optical section, I+ orange-yellow, KI+ orange-yellow. Pycnidia not seen. Spot tests: thallus and perithecia P–, K–, KC–, C–, UV–.

**Distribution and ecology.** Coastal corticolous species, only known from Morane atoll.

**Etymology.** The species is dedicated to the French malacologist Olivier Gargominy (ORCID: 0000-0001-7807-944X), who dedicates his life to improving knowledge of terrestrial snails from mainland France, Corsica, and overseas territories: French Guyana, French Polynesia, and New Caledonia. Beyond malacology, he also makes a significant contribution to biodiversity knowledge and conservation through the TAXREF program (Gargominy et al. 2022), which aims at listing all living organisms from French territories, and counts among the major contributors to the GBIF Backbone Taxonomy (GBIF Secretariat 2023b).



**Figure 2.** *Agonimia gargominyi*, holotype, MNHN-PC-PC0779835. A–C – habitus (thallus and a perithecioid ascoma marked with a red arrow); D – habitus (thallus). Scales: A–D = 1 mm.



**Figure 3.** *Agonimia gargominyi*, holotype, MNHN-PC-PC0779835. A – habitus (thallus and perithecioid ascoma); B – sectioned perithecioid ascoma showing the 3-layered excipulum; C – drawing of the habitus; D – drawing of the squamules. Drawings A–H. Paradis. Scales: A = 1 mm; B = 0.5 mm; C = 0.2 mm; D = 1 mm.

**Notes.** *Agonimia gargominyi* shares the prominent barrel-shaped perithecia, which are relatively wide, with *A. tristicula*. However, there are notable differences between the two species. In *A. tristicula*, the ascomata are black throughout, outside mat and rough, with furrowed ostiolar region, the asci are 2-spored, the ascospores are larger, and the thallus squamules appear green only when wet. When compared to other species within the same genus, there are several key distinguishing characteristics of *Agonimia gargominyi*. These include a fertile thallus that lacks hair-like structures, the absence of asexual dispersal organs such as isidioids or soredia, the presence of distinctly papillate cortical cells, the relatively large lobate to finger-shaped squamules, the barrel-shaped to sub-pyriform perithecia with a pale brown-colored ostiolar region, and the hemiamyloid hymenial gel.

**Key to the species of *Agonimia* (modified from Breuss 2020)**

The following key is a modified version based on the key to the 24 *Agonimia* species compiled by Breuss (2020). It includes only the nodes that have been modified from the original key

(they are marked with a letter). For a comprehensive key to the genus, please refer to Breuss (2020) and compare it with the modified nodes provided below.

- 1 Thallus sterile (perithecia not known or rare, or sterile specimens frequently found) ..... 2
- Thallus with perithecia ..... 14
- 2 to 13 ..... Not included
- 14 Perithecia barrel-shaped, with a well-defined longitudinally furrowed (plicate) neck ..... 15a
- Perithecia globose to ovoid, smooth or roughened, but without a distinct plicate neck ..... 16
- 15a Asci 2-spored. Spores (60–)80–120(–150) × 25–50 μm. Perithecia 0.3–0.5 mm wide. Thallus squamulose; squamules up to 1 mm long, dispersed to crowded, nodulose or elongate finger-like, terete to flattened. – Terricolous, rarely on bark. Cosmopolitan. .... *A. tristicula*
- Asci 8-spored ..... 15b
- 15b Asci 8-spored. Spores 20–40(–47) × 12–20 μm. Perithecia small (0.18–0.22 mm wide). Thallus granular-verrucose or minutely squamulose; squamules up to 0.25 mm long. – On mossy bark and rocks. Europe. . . . . *A. repleta*

Asci 8-spored. Spores  $37\text{--}48 \times 17\text{--}21 \mu\text{m}$ . Perithecia large ( $0.35\text{--}0.40 \times 0.45\text{--}0.5 \text{ mm}$ ). Thallus minutely squamulose, continuous or discontinuous; squamules up to 1.1 mm long (often appearing lobed), frequently evolving to elongated finger-like squamules of 0.4–1 mm in length. – On bark, at sea level under tropical rainforest climate. French Polynesia . . . . . *A. gargominyi*

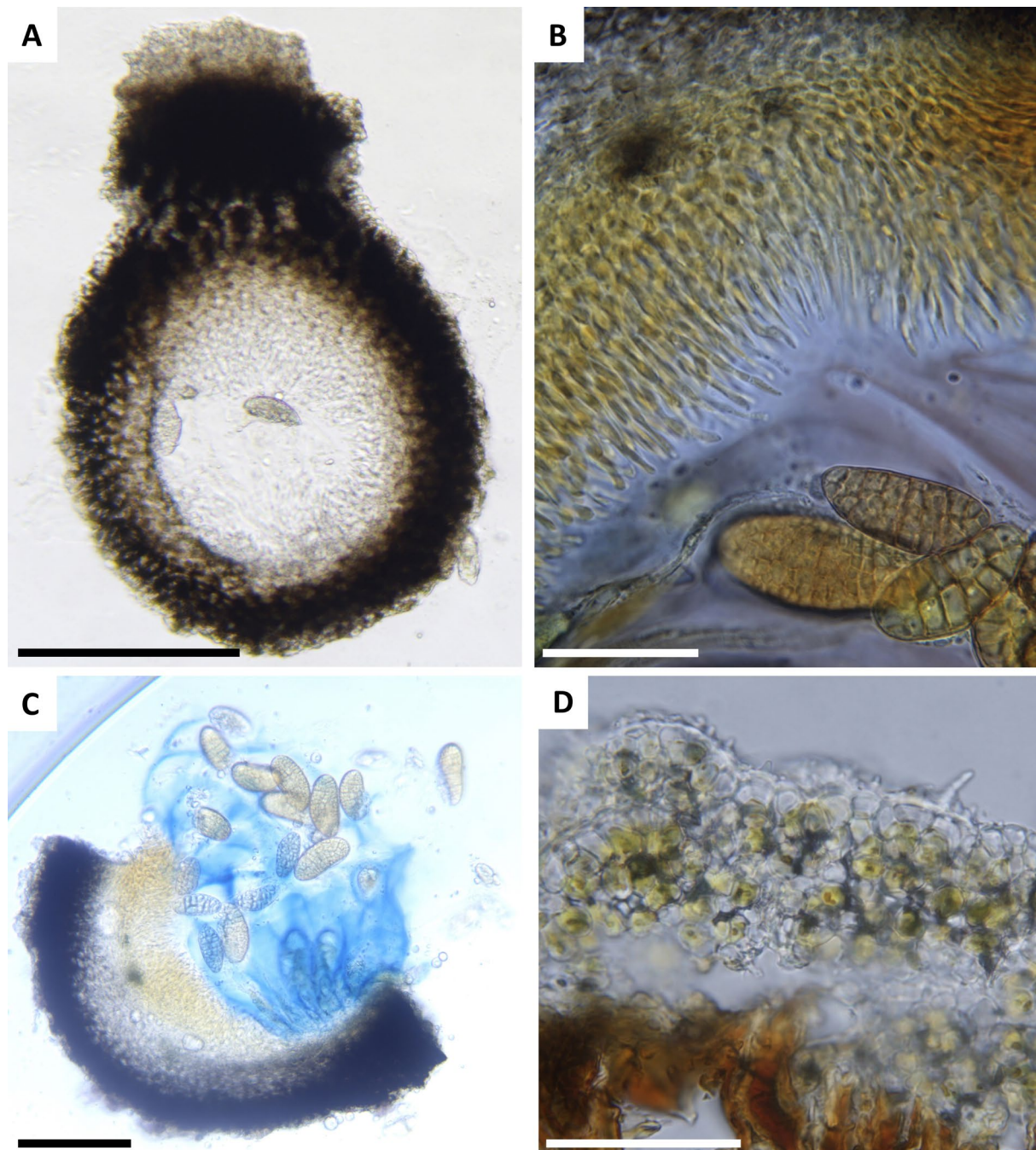
16 to 27 . . . . . Not included

## Discussion

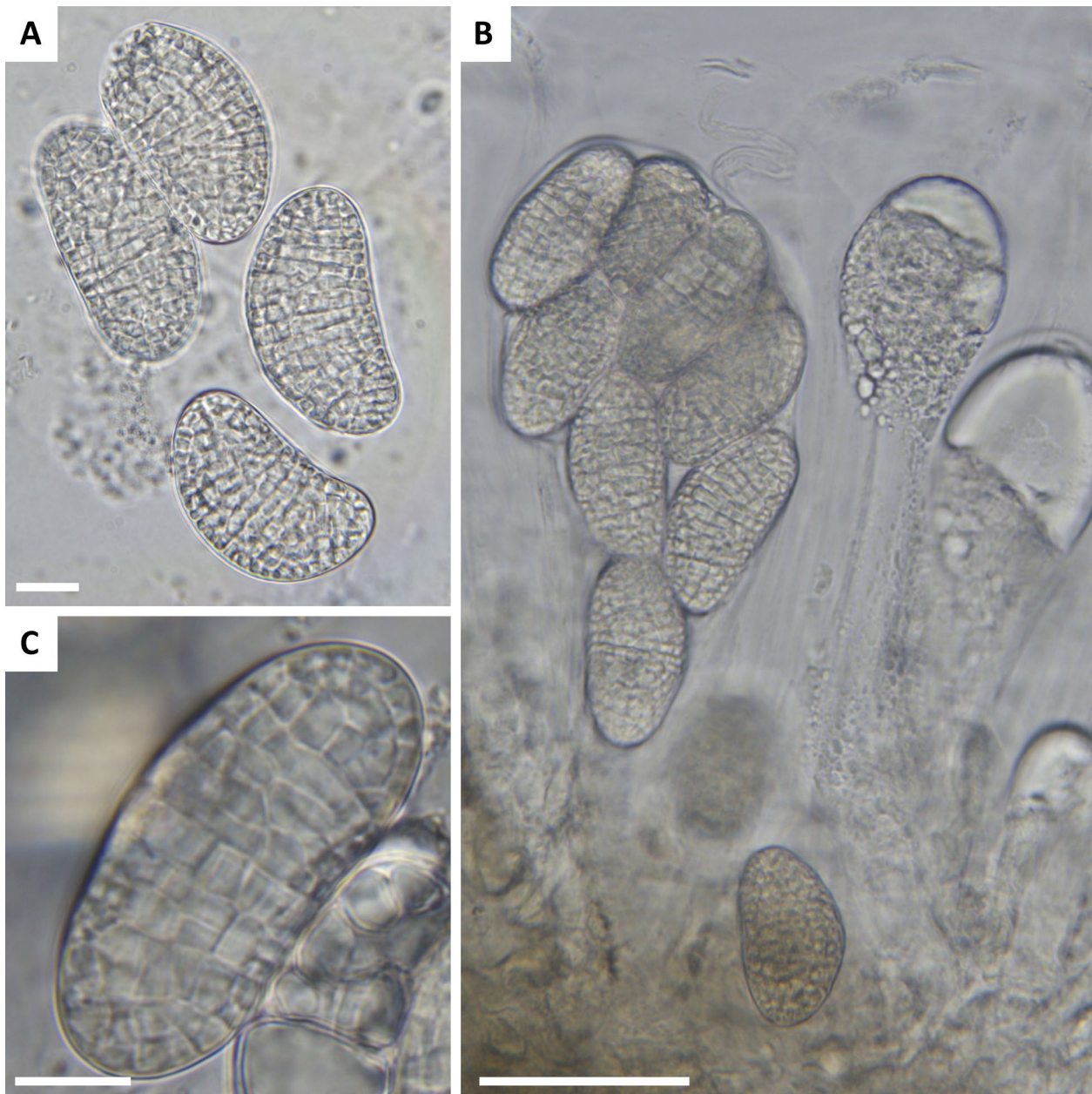
The characterization of *A. gargominyi* expands the diversity of the *Agonimia* genus to 25 species. According to the

key compiled by Breuss (2020), *A. gargominyi* falls within a group of species that frequently exhibit sexual dispersal capabilities. In fact, 15 species (65%) within the genus demonstrate such capabilities. Among them, four species have 2- to 4-spored asci, while the remaining species have 4- to 8-spored asci. The remaining *Agonimia* species either possess asexual dispersal organs (one species producing isidioid outgrowths and soredia, and two species solely having soredia) or lack such specialized structures altogether. This suggests that thallus fragmentation likely plays a significant role in the dispersal of these species.

In terms of ecological niche, the majority of *Agonimia* species are corticolous (12 species, 52%), including



**Figure 4.** *Agonimia gargominyi*, holotype, MNHN-PC-PC0779835. A – perithecioid ascoma in vertical section in water; B – periphyses and ascospores in I (note the wine tinge of the hymenial gel); C – perithecioid ascoma in vertical section in KI showing the blueish tinge of the hymenial gel; D – squamule in vertical section in water showing the photobiont and the single-layered cortex with papillate cells. Scales: A = 200  $\mu\text{m}$ ; B = 30  $\mu\text{m}$ ; C = 100  $\mu\text{m}$ , D = 100  $\mu\text{m}$ .



**Figure 5.** *Agonimia gargominyi*, holotype, PC 0779835. A – ascospores in water; B – asci with ascospores in water; C – ascospore in water. Scales: A = 10  $\mu\text{m}$ ; B = 50  $\mu\text{m}$ ; C = 10  $\mu\text{m}$ .

*A. gargominyi* that was found growing on the native tree *Guettarda speciosa* L. (*Rubiaceae*), a species commonly found on atolls and coastal forests of high islands. The remaining species are saxicolous (8 species), terricolous (7 species), or lichenicolous (2 species). When mapping the known distribution of species (Breuss 2020; GBIF Secretariat 2023c; Meise Botanic Garden 2023) to the terrestrial ecoregions of the world (Olson et al. 2001), most *Agonimia* species are observed in the Palearctic ecoregion, encompassing 18 species (78.3%). Among these, 14 species occur in the Eastern Palearctic ecoregion, 10 species are found in the Western Palearctic ecoregion, and only five species found in both sub-ecoregions. The remaining *Agonimia* species are distributed across the Nearctic (5 species), Neotropic (5 species), Australasia (3 species), Oceania (3 species), and Afrotropic (3 species) ecoregions.

Morane atoll is located within the Oceania ecoregion, which exhibits relatively low diversity within the *Agonimia* genus. However, it is situated adjacent to the Eastern Palearctic region, which could be considered as a potential center of diversification for the genus. The species inventory of Morane atoll currently includes six taxa identified at the species level, along with four at the genus level (Meyer & Poncet 2021). Among these, five species have a pantropical distribution, while one species (*Ramalina leiodea* (Nyl.) Nyl.) is restricted to the Australasia and Oceania ecoregions. Considering the climatic and edaphic parameters shared by Morane atoll and other locations within the Oceania ecoregion, as well as the (at least) sexual dispersal capabilities of *A. gargominyi* and the occurrence of widespread species within the study area, it is highly plausible that the newly characterized species can be found in other geographical locations as well.

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