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LICHENS AND LICHENICOLOUS FUNGI OF THE AZORES (PICO, SÃO JORGE), ADDITIONAL RECORDS AND FOUR NEW SPECIES

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One hundred twelve lichens and lichenicolous fungi species are recorded for the Azores. Twelve species are new records for the archipelago. A list with new records for the islands Pico and/or São Jorge is presented. Four species are newly described: *Gassicurtia azorica*, *Polycoccum parmotrematis*, *Rinodina subcolobina* and *Stigmidium pyrenulae*.

Key words: biodiversity in lichens and lichenicolous fungi, ecology, Macaronesia, new records, taxonomy.

INTRODUCTION

The Azores is an archipelago in the North Atlantic Ocean, comprising 9 inhabited volcanic islands. The main island, São Miguel, is situated 1,360 km west of continental Portugal. This archipelago presents a mild climate with average daily temperatures of 16–25 °C, with lowest temperature never below 4 °C. The average annual rainfall increases from east to west ranging from 700 to 1600 mm and in the east to 6,300 mm on Mount Pico, the highest altitudes of the archipelago, which can be found on the island Pico, reaching 2,350 m altitude. After the main island São Miquel, Pico is the second largest island with 446 km^2, with a population of 14,148 inhabitants, São Jorge, the fourth island with 246 km^2, has 9,171 inhabitants (data from 2019, source: Wikipedia).

The flora of lichens and lichenicolous fungi received rather a lot of attention in recent years (Aptroot *et al.* 2009, Breuss 2018, Etayo 2018, van den Boom 2015, 2016, van den Boom and Alvarado 2019, Guzow-Krzemińska *et al.* 2019 and Schumm and Aptroot 2013).

A study comparable with the presented study has been made recently about two Azores islands, São Miguel and Terceira, in which one hundred records are published, including seven new species (van den Boom 2016). During a visit of the two islands Pico and São Jorge, central in the archipelago, in 2017, just over 500 specimens have been collected. The aim of this paper is to present the results of this collecting trip including the description of species new to science and the addition of further species to the Azores checklist. One hundred twelve species are recorded as new to at least one of the visited

islands, twelve species are new records for the Azores Archipelago and 4 species are newly described for science, *Gassicurtia azorica*, *Polycoccum parmotrematis*, *Rinodina subcolobina* and *Stigmidium pyrenulae.*

MATERIALS AND METHODS

All specimens have been studied by conventional macro- and microscopical techniques with hand-cut sections of the material mounted in tap water. Amyloid reactions were tested using Lugol's iodine solution (K/I). Voucher specimens are kept in the herbarium of P. van den Boom, some specimens are deposited in the herbarium of Berlin (B). Distribution data in Macaronesia were taken from the checklists of the Azores (Aptroot *et al.* 2010, Gabriel 2008) as well as papers published more recently (Etayo 2018, Guzow-Krzemińska *et al.* 2019, van den Boom 2016 and van den Boom and Alvarado 2019). Species newly recorded to the Azores are marked with an asterisk. In Figure 1, the position of islands of the Azores are visible, with Pico (P) and São Jorge (SJ) in the central part.

Collecting sites, Azores (Pico and São Jorge)

Loc. 1 = Pico, E of Madalena, Parque Florestal da Quinta das Rosas, botanical garden with mixed shrubs and trees, including some exotic trees, 38° 31.38′ N, 28° 29.38′ W, 150 m, 29.08.2017.

Loc. 2 = Pico, ESE of São Roque, near Prainha de Cima, Reserva Florestal da Prainha, picnic area with mixed shrubs and trees, 38° 29.32′ N, 28° 14.70′ W, 230 m, 29.08.2017.

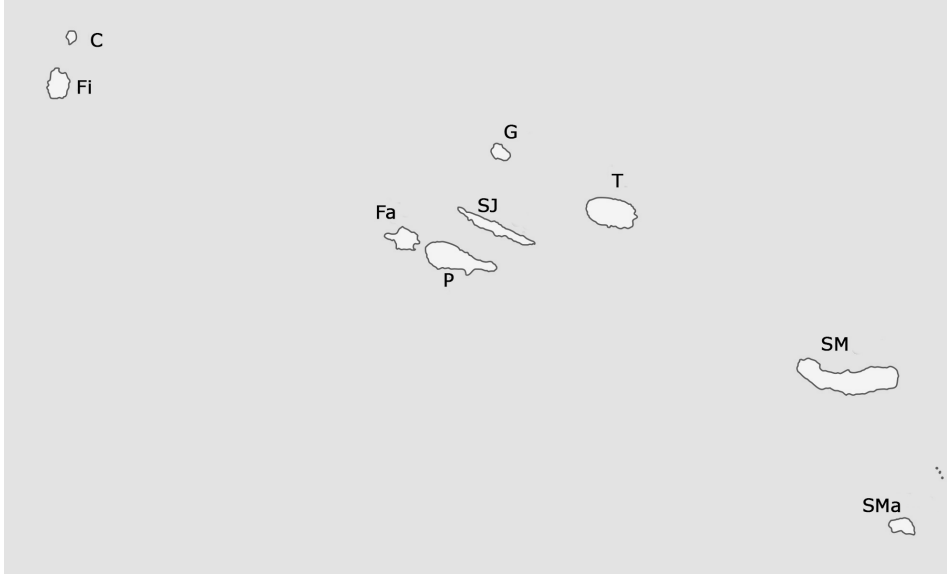

Fig. 1. The islands of the Azores Archipelago: C = Corvo; Fi = Floris; Fa = Faial; G = Graciosa; P = Pico; SJ = São Jorge; SM = São Miguel; SMa = Santa Maria; T = Terceira

Loc. 3 = Pico, SE of São Roque, SW of Prainha, secondary road on mountain range, Cabeço da Cheira, *Erica* and *Juniperus* shrubs and trees in meadow, 38° 27.82′ N, 28° 14.01′ W, 500 m, 30.08.2017.

Loc. 4 = Pico, S of Prainha, secondary road on mountain range, Cabrais, mirador, *Ilex* shrubs and wood of fence, 38° 26.75′ N, 28° 11.95′ W, 640 m, 30.08.2017.

Loc. 5 = Pico, S of Prainha, secondary road on mountain range, Cabeço do Caveiro, *Erica* and *Ilex* shrubs along road, 38° 26.08′ N, 28° 12.20′ W, 925 m, 30.08.2017.

Loc. 6 = Pico, S of Prainha, secondary road on mountain range, Lagoa do Caiado, *Erica* and young *Cryptomeria* trees along road and field, 38° 27.40′ N, 28° 14.88′ W, 815 m, 30.08.2017.

Loc. 7 = Pico, SE of São Roque, N of secondary road on mountain range, Caminho dos Burros, trail from south to north, near Cabeços do Misténo, *Erica* and *Ilex* shrubs and trees in open area, 38° 27.86′ N, 28° 16.53′ W, 780 m, 30.08.2017.

Loc. 8 = Pico, SSE of São Roque, secondary road on mountain range, W of Cabeços do Silvado, towards road ER2, near Cabeços do Redondo, roadside trees and shrubs, including *Erica*, *Ilex* and *Frangula*, 38° 27.98′ N, 28° 17.62′ W, 700 m, 30.08.2017.

Loc. 9 = Pico, WSW of Piedade, 1 km W of Ribeirinha, near mirador, along road ER1, roadside trees, including *Cryptomeria* and *Metrosideros excelsa*, 38° 26.51′ N, 28° 06.27′ W, 380 m, 31.08.2017.

Loc. 10 = Pico, SE of Piedade, W of Manhenha, S exposed coastal volcanic rocks and wall of stones, 38° 24.50′ N, 28° 02.50′ W, 15 m, 31.08.2017.

Loc. 11 = Pico, SSE of Piedade, Cabeço da Junça, florestal, Parque Matos Souto, mixed trees and shrubs, 38° 25.17′ N, 28° 3.54′ W, 150 m, 31.08.2017.

Loc. 12 = Pico, S of São Roque, secondary road on mountain range, from east (500 m) of main road ER2 to direction of Arrife, roadside trees and shrubs, including *Erica*, *Ilex* and *Laurus azorica*, 38° 26.95′ N, 28° 18.36′ W, 555 m, 31.08.2017.

Loc. 13 = Pico, between Santo Antonio and S of São Roque, small garden of freestanding house, S of road ER1, 38° 31.99′ N, 28° 19.97′ W, 20 m, 31.08.2017.

Loc. 14 = Pico, ESE of Madalena, E slope of volcano Pico, along small steep trail to the top of the volcano, shrubs of *Erica* abundantly present, 38° 28.20′ N, 28° 25.47′ W, 1,235 m, 01.09.2017.

Loc. 15 = Pico, SE of Madalena, secondary road on mountain range, from Capitão to São Mateus, SW slope of volcano Pico, trees and shrubs in a meadow, including mainly *Erica* and some *Ilex* and *Laurus azorica*, 38° 27.54′ N, 28° 26.20′ W, 990 m, 01.09.2017.

Loc. 16 = Pico, S of São Roque, secondary road on mountain range, west of main road ER2, from Cabecinhos to Cabeço do Mariano, meadow with some rows of shrubs and young trees, including *Erica*, *Ilex* and *Laurus azorica*, 38° 26.50′ N, 28° 19.23′ W, 520 m, 01.09.2017.

Loc. 17 = Pico, S of São Roque, secondary road on mountain range, from east (700 m) of main road ER2 to direction of Arrife, roadside trees and shrubs, including *Erica*, *Ilex* and *Laurus azorica*, 38° 26.95′ N, 28° 17.90′ W, 560 m, 01.09.2017.

Loc. 18 = Pico, S of São Roque, N of road ER3, Lagoa do Capitão, open area with some trees of *Juniperus brevifolia* at E side near lake, 38° 29.20′ N, 28° 19.09′ W, 720 m, 02.09.2017.

Loc. 19 = Pico, ESE of Madalena, NNW slope of volcano Pico, SSW of Santa Luzia, N of main road ER3, along small road from Redondo to Lourenço Nunes, N sloping mixed forest, including *Erica*, *Ilex*, *Laurus* and *Pinus*, 38° 30.12′ N, 28° 25.18′ W, 770 m, 02.09.2017.

Loc. 20 = Pico, 2 km W of São João, Reserva Florestal São João, S side of road ER1, picnic area with a small *Pinus-Pittosporum* forest, 38° 25.06′ N, 28° 21.72′ W, 85 m, 02.09.2017.

Loc. 21 = São Jorge, NW of Velas, 3 km NW of Rosais, Reserva Florestal das Sete Fontes, mixed forest including many *Camellia* shrubs, 38° 44.15′ N, 28° 15.73′ W, 415 m, 03.09.2017.
Loc. 22 = São Jorge, SW of Norte Grande, very small road on mountain range, near Rio da Casda Velha, road in mixed forest, 38° 39.62′ N, 28° 04.21′ W, 640 m, 04.09.2017.
Loc. 23 = São Jorge, E of Santo Amaro, Reserva Florestal das Macelas, small open forest with mixed trees and shrubs, including *Metrosideros* trees and *Camellia* shrubs, 38° 40.61′ N, 28° 09.78′ W, 450 m, 04.09.2017.
Loc. 24 = São Jorge, NE of Calheta, Reserva Florestal da Silveira, picnic area, small open forest with mixed trees and shrubs, including *Pinus*, *Cryptomeria*, tree ferns and *Camellia* shrubs, 38° 36.79′ N, 27° 58.62′ W, 290 m, 05.09.2017.
Loc. 25 = São Jorge, SW of Manadas, Sta. Barbara, trees near church and old walls of stones, 38° 37.92′ N, 28° 05.82′ W, 15 m, 05.09.2017.
Loc. 26 = São Jorge, N of Calheta, along road ER1 (E side), to Norte Pequeno, E of Pico Meio, *ca* 500 m S of crossing to Silveira, meadow with some *Erica* shrubs, and *Laurus azorica* at edge of small forest, 38° 37.91′ N, 27° 59.75′ W, 470 m, 06.09.2017.
Loc. 27 = São Jorge, N of Calheta, along small road, E crossing with road ER1, E of Pico Meio, road to Silveira, group of *Cryptomeria* trees, 38° 37.78′ N, 27° 59.02′ W, 455 m, 06.09.2017.
Loc. 28 = São Jorge, NNE of Urzelina, highest mountain range, between Pico do Pedro and Pico Verde, along small unpaved road, some young *Pinus* trees on N exposed grassy slope, 38° 39.83′ N, 28° 06.09′ W, 835 m, 06.09.2017.
Loc. 29 = São Jorge, NNE of Urzelina, highest mountain range, between Pico Verde and Morro Pelado, grassy strong slope along unpaved road, 38° 39.29′ N, 28° 05.45′ W, 915 m, 06.09.2017.
Loc. 30 = São Jorge, W of Urzelina, secondary road from Urzelina to Ribeira do Nabo, neglected large garden, including *Eucalyptus*, *Pinus* and *Pittosporum*, 38° 39.33′ N, 28° 08.31′ W, 455 m, 06.09.2017.
Loc. 31 = São Jorge, NW of Velas, WNW of Rosais, trail to Farol dos Rosais, near Cha do Areeiro, small forest with *Erica* and *Pittosporum* and stones of walls, 38° 44.82′ N, 028° 17.92′ W, 290 m, 07.09.2017.
Loc. 32 = São Jorge, NW of Velas, 3 km NW of Rosais, Reserva Florestal das Sete Fontes, mixed forest including many *Camellia* shrubs, 38° 44.18′ N, 28° 15.64′ W, 410 m, 07.09.2017.
Loc. 33 = São Jorge, Velas, S side of the town, near natural swimming pool, volcanic outcrops at coast, 38° 40.70′ N, 28° 12.55′ W, 9 m, 07.09.2017.

NEW SPECIES

Gassicurtia azorica van den Boom, *spec. nova*
(Fig. 2A–B)

Mycobank: MB 836343

A Gassicurtia *species, thallus smooth to slightly uneven, whitish, apothecia black, sessile with a reddish rim at the lower side of the margin, up to 0.7 mm diam., often slightly brownish pruinose, excipulum C+ yellowish, hypothecium blackish, ca 50 μm high, K+ purplish violet. Asci 8-spored, ascospores 8–10 × 2.7–4 μm.*

Type: Portugal, Azores, Pico, ESE of São Roque, near Prainha de Cima, Reserva Florestal da Prainha, picnic area with mixed shrubs and trees, 38° 29.32′ N, 28° 14.70′ W, 230 m, 29.08.2017, P. & B. van den Boom 56593 (B, holotype; hb. v. d. Boom, isotype).

Description: thallus smooth to slightly uneven, whitish to pale greyish, without reddish pigment; hypothallus not observed; photobiont chlorococcoid; algal cells 5 to 10 μm diam.; apothecia, up to 0.7 mm diam., sessile, somewhat

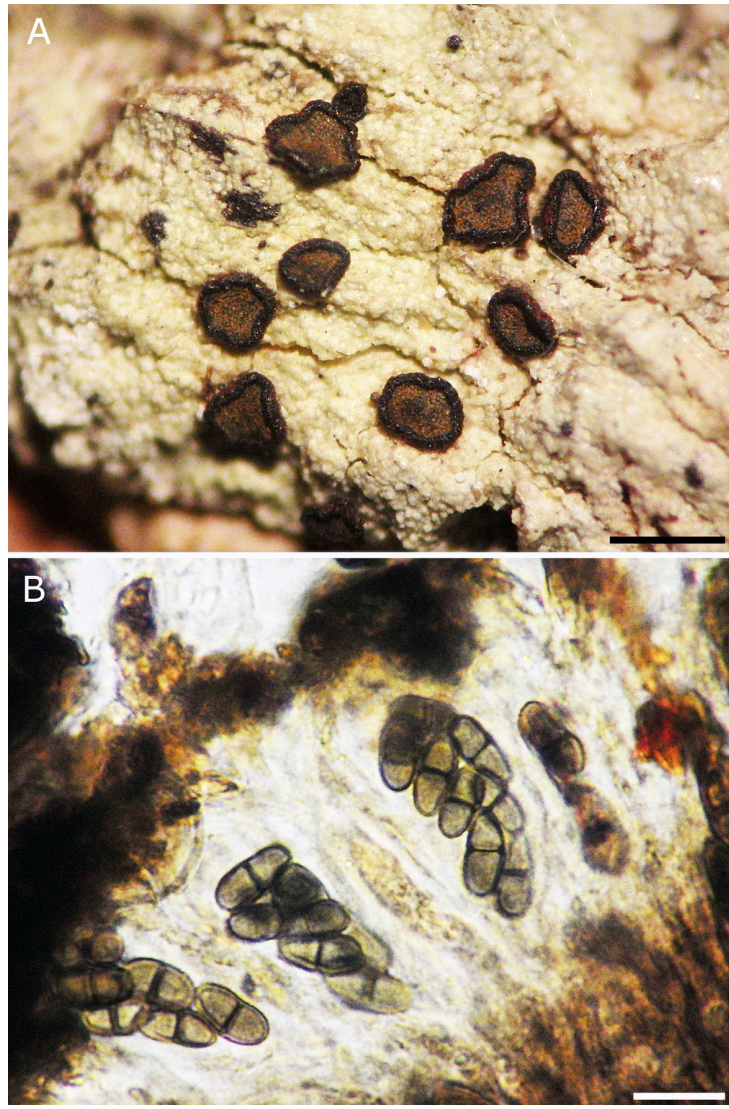

Fig. 2. Gassicurtia azorica (holotype): A= habitus (scale = 0.5 mm); B = section of the hymenium with ascospores in asci (scale = 10 μm)

constricted at base, flat, margin thin, black, persistent, with an outer reddish rim at the lower side; disc black, often slightly brownish pruinose; excipulum blackish, C+ yellowish; hymenium clear, pale brownish to pale purplish; hypothecium blackish, *ca* 50 μm high, K+ purplish violet; asci 8-spored, 25–30 × 10–14 μm; ascospores 8–10 × 2.7–4 μm, smooth surface, brown. Pycnidia not detected. Chemistry: thallus C+ orange, K–, KC+ orange, P–, UV+ dark reddish. Thiophanic and 3-O-methylthiophanic acids detected by TLC.

Etymology: The epithet refers to the archipelago where the species occurs.

Distribution and ecology: This species is known from two localities, both situated at an elevation of 230 m. It is the first species of the genus detected from Europe. All collections are from a trunk of *Myrica faya* or *Pinus* sp. In the type locality, a mixed forest, it was abundantly present on several rather small trees.

Notes: *Gassicurtia azorica* (Caliciaceae) is the most similar to *G. coccinoides* Marbach, a species known from South America, West Indies and Kenia (Marbach 2000). That species has epruinose apothecia of up to 0.4(–0.5) mm diam., a very high hypothecium of 140–200 μm and ascospores of 9–11(–12) × 3.5–4.5(–5) μm. A further Neotropical species, *Gassicurtia manguensia* Marbach has also brownish pruinose, black apothecia of up to 0.3 mm diam., but it has 16-spored asci and the thallus is verrucose to subgranular (Marbach 2000).

Additional specimen examined: Portugal, Azores, Pico, ESE of São Roque, near Prainha de Cima, Reserva Florestal da Prainha, picnic area with mixed shrubs and trees, on *Pinus*, 38° 29.32′ N, 28° 14.70′ W, 230 m, 29.08.2017, P. & B. van den Boom 56607 (hb. v. d. Boom).

Polycoccum parmotrematis van den Boom, *spec. nova*
(Fig. 3A–B)

Mycobank: MB 836344

Lichenicolous fungus, immersed in the thallus of a corticolous Parmotrema *sp., similar to* Polycoccum micropunctum *Etayo, but differing in smaller ascomata of 40–70 μm diam., smaller asci of 50–75 × 18–20 μm and smaller ascospores of 12–15 × 7–8 μm, septum towards lower end of ascospore.*

Type: Portugal, Azores, São Jorge, N of Calheta, along small road, E crossing with road ER1, E of Pico Meio, road to Silveira, group of *Cryptomeria* trees, 38° 37.78′ N, 27° 59.02′ W, 455 m, 06.09.2017, P. & B. van den Boom 57147 (B, holotype; hb. v. d. Boom, isotype).

Description: Ascomata regularly dispersed in the thallus of the host, immersed, only visible by the black ostiole, subglobose, very small, 40–70 μm diam., on the thallus of *Parmotrema* sp.; exciple hyaline to light brownish below, *ca* 5 μm thick, and reddish to dark brown in the upper part that is

thickened up to 15 μm thick, composed of several layers of cells forming a paraplectenchymatous structure; hymenial gelatine hyaline, I–; pseudoparaphyses abundant, septate, simple to branched and sometimes anastomosing, *ca* 1.5–2.5 μm wide; asci abundant, bitunicate, wall apically thickened, claviform to subcylindrical, 8-spored, 50–75 × 18–20 μm; ascospores biseriately

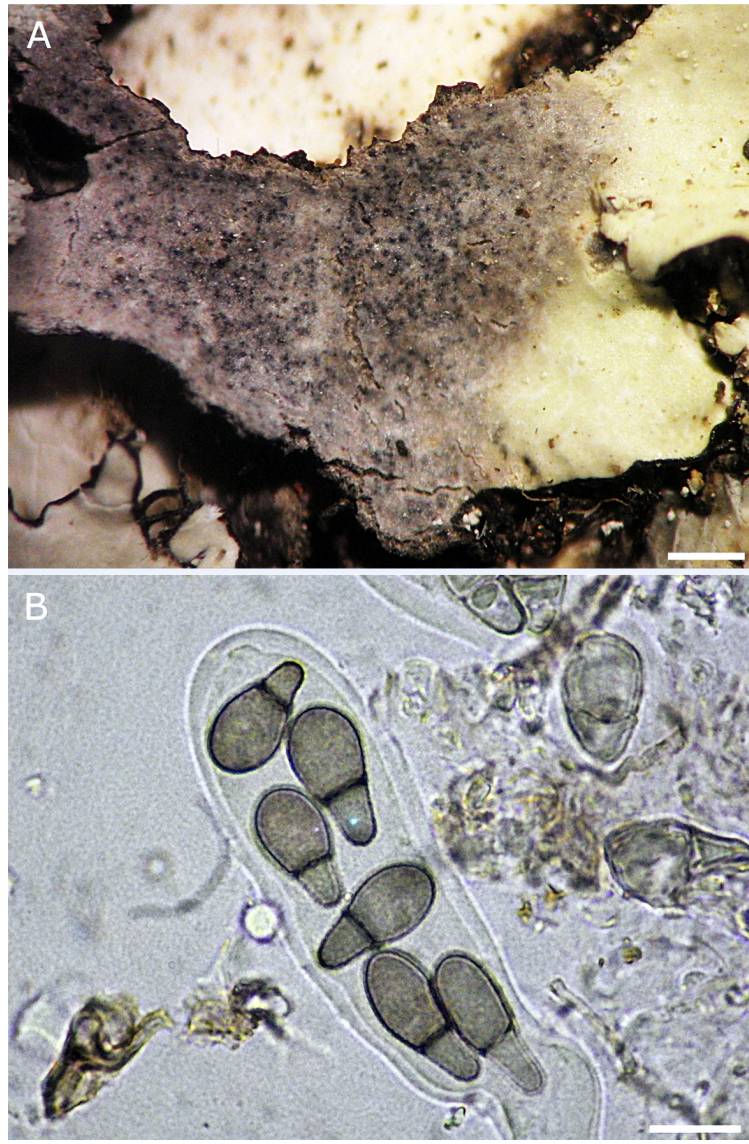

Fig. 3. Polycoccum parmotrematis (holotype): A = habitus (scale = 0.5 mm); B = ascospores in ascus (scale = 10 μm)

or irregularly arranged, ellipsoid, septum clearly towards lower end of ascospore, so the lower cell is much smaller than the upper one, brown, 1-septate, without a perispore, with a fine farinose surface, with one large or two smaller oil guttules in each cell, 12–15 × 7–8 μm. Conidiomata not observed.

Etymology: The epithet refers to the host genus.

Distribution and ecology: *Polycoccum parmotrematis* is known from the type locality in the Azores (São Jorge), where it is abundantly present on a trunk of a *Cryptomeria* tree, growing on the thallus of an unknown, corticolous *Parmotrema* sp. with scattered sorediate tips, very similar to those of *Parmotrema reticulatum*.

Notes: The most distinctive character of *Polycoccum parmotrematis* (Dacampiaceae) is inducing violet coloured thallus of the host species (*Parmotrema* sp.) with the abundantly immersed perithecia and the relatively small size of its structures, ascospores are biseriately arranged in the asci. *Polycoccum montis-wilhelmii* Diederich, the first known species of *Polycoccum* growing on *Parmelia* s. l. described from Papua New Guinea has larger ascomata of 100–130 μm diam., smaller asci of 12–15 μm wide and verrucose spores when mature, 14.5–16 × 6.5–7 μm, it is gall-forming, growing on *Hypotrachyna sinuosa* (Aptroot *et al.* 1997). *P. montis-wilhelmii* has recently been recorded from Terceira by van den Boom (2016) and Etayo (2018). Only one other species of *Polycoccum* grows on a member of the Parmeliaceae, *P. crespoae* Váczi et D. Hawksw. It is described from Australia, growing on *Xanthoparmelia,* it has larger ascomata than the new species (115–135 μm), the ascospores are 17–20 × 6.5–7.5 μm and the upper cell is somewhat larger than the lower, this species not producing galls (Váczi and Hawksworth 2001). *P. nigrosporum* Etayo and *P. epizoharyi* Calatayud et V. Atienza, grow on crustose lichens, but they have larger ascospores (13.5–16 × 8–9.5 μm and 14–18 × 7–10 μm, respectively) and the hosts are from different genera (*Diplotomma* and *Buellia*) (Atienza *et al.* 2003).

The only *Polycoccum* species in the checklist of the Azores is *P. squamarioides* (Mudd) Arnold (Aptroot *et al.* 2010), but that species has much longer ascospores (18–26 × 5–8 μm) and is known from different crustose lichens. *Didymocyrtis micropunctum* Etayo is a species for which *P. parmotrematis* is easily overlooked, because this species has also small immersed perithecia of 70–120 μm diam., 1-septate brown ascospores of 10.5–15 × 4–6 μm. However, the difference of *Didymocyrtis* with *Polycoccum* is that the former genus has ascospores monoseriately arranged in the asci and relative thin pseudoparaphyses (Ertz *et al.* 2015).

Rinodina subcolobina van den Boom, *spec. nova*
(Fig. 4A–B)

Mycobank: MB 836345

Thallus very thin, continuous (ca 0.05 mm thick), pale grey to grey; prothallus absent, medulla not amyloid, I–; photobiont chlorococcoid, algal cells up to 12 μm diam.; apothecia thalline, 0.3–0.6 mm diam., sessile; epihymenium violet brown, K+ red, N–; ascospores 1-septate, 15–19 × 8–10 μm, ellipsoid, similar to the Mischoblastia*-type, brown, not ornamented; ontogeny type-A.*

Type: Portugal, Azores, Pico, S of São Roque, secondary road on mountain range, from east (700 m) of main road ER2 to direction of Arrife, roadside trees and shrubs, including on *Erica*, *Ilex* and *Laurus azorica*, on *Erica*, 38° 26.95′ N, 28° 17.90′ W, 560 m, 01.09.2017, P. & B. van den Boom 56861 (B, holotype; hb. v. d. Boom, isotype).

Description: Thallus very thin, continuous (*ca* 0.05 mm thick), pale grey to grey; prothallus absent; medulla not amyloid, I–; photobiont chlorococcoid; thalline cells up to 12 μm diam.; apothecia, 0.3–0.6 mm diam., sessile; margin rather thick and prominent in young apothecia, becoming thinner, usually persistent, grey; disc slightly concave to plane, rarely becoming subconvex, epruinose, dark brown to black; proper exciple, wide, composed of rounded cells 5–7 μm diam., outer part dark brown, inner part hyaline; epihymenium violet brown, K+ red, N–; hymenium hyaline, clear, without oil droplets, 55–65 μm high; hypothecium up to 30–45 μm deep, hyaline, ±inspersed with oil droplets; asci *Bacidia*-type, 8-spored, 38–45 × 17–22 μm; paraphyses with apical cells of 3–4 μm wide, with brown caps; ascospores 1-septate, 15–19 × 8–10 μm, ellipsoid, similar to the *Mischoblastia*-type, brown, not ornamented. Ontogeny type-A (the septum is inserted before inner wall thickenings become distinct). Pycnidia and conidia not seen. Chemistry: all spot tests negative. Zeorin and traces of gyrophoric acid detected by TLC.

Etymology: The epithet refers to the similarity of *Rinodina colobina*.

Distribution and ecology: This species is known from two localities, both situated at an elevation between 450 and 560 m. Type collection is from branches and twigs of *Erica*. In the type locality, a mixed forest, it was abundantly present on several rather small trees.

Notes: The new species belongs in the *Rinodina colobina* group (Physciaceae) with species as *R. colobina* (Ach.) Th. Fr., *R. mayrhoferi* A. Crespo and *R. pityrea* Ropin et H. Mayrhofer, a blue-grey pigment reacting K+, N+ and C+ violet in thallus and epithecium. These characters are always correlated with a granulose blastidiate thallus (Giralt 2001), so this is the first non-blastidiate species of the group. In the key of Sheard (2018), *Rinodina* of North America,

not any species have been found which is related to the new species. However, *Rinodina wetmorei* Sheard has *Mischoblastia*-type ascospores, but they are >20 μm long and the sorediate thallus is dark grey to ochraceous and only known from North America at higher altitudes in Minnesota (Sheard 2018).

Additional specimen examined: Portugal, São Jorge, E of Santo Amaro, Reserva Florestal das Macelas, small open forest with mixed trees and shrubs, including *Metrosideros* trees, *Camellia* and *Erica* shrubs, 38° 40.61′ N, 28° 09.78′ W, 450 m, 04.09.2017, P. & B. van den Boom 57044 (hb. v. d. Boom).

Fig. 4. Rinodina subcolobina (holotype): A = habitus (scale = 1 mm); B = ascospores (scale = 10 μm)

Stigmidium pyrenulae van den Boom, *spec. nova*
(Fig. 5A–B)

Mycobank: MB 836347

Lichenicolous fungus, ascomata perithecioid, subglobose to globose, immersed or semi-immersed, 150 to 300 μm in diam., peridium pseudoparaplectenchymatous, medium brown; hymenium I–, interascal filaments relative long; asci 40–60 × 9–15 μm, 8-spored; ascospores hyaline, (12–)14–18(–20) × (3–)3.5–4.5(–5) μm, 1(–2)-septate.

Type: Portugal, Azores, Pico, SSE of São Roque, secondary road on mountain range, W of Cabeços do Silvado, towards road ER2, near Cabeços do Redondo, roadside trees and shrubs, including *Erica*, *Ilex* and *Frangula*, 38° 27.98′ N, 28° 17.62′ W, 700 m, 30.08.2017, P. & B. van den Boom 56708 (B, holotype; hb. v. d. Boom, isotype).

Description: Vegetative hyphae poorly developed, colourless, smooth, I–; ascomata perithecioid, black, shiny, subglobose to globose, sometimes somewhat conical above, with an ostiole, without appendices or projections, 150 to 300 μm in diam., immersed to semi-immersed in the host thallus, numerous, dispersed, occasionally aggregated; peridium pseudoparaplectenchymatous, medium brown, evenly coloured, in surface view of textura angularis, up to 10 μm thick, composed of unevenly pigmented cells of 2.5–4 μm across, K–, I–; hymenial gel I–, K/I–; ostiolar filaments not developed; interascal filaments relative long, 1–1.5 μm wide, branched; asci bitunicate, usually markedly thickened below the middle, often with a distinct long foot, endoascus strongly thickened above, internal apical beak often distinct and long, 40–60 × 9–15 μm, 8-spored, I–, K/I–, with a paler area just above apical beak; ascospores colourless, surface smooth, without a perispore, narrowly fusiform, occasionally narrowly obovate, with the greatest breadth above the middle, (12–)14–18(–20) × (3–)3.5–4.5(–5) μm, 1(–2)-septate, not or slightly constricted at the septum, but sometimes with 1–2 oil guttules per cell, overlapping in 2–3 rows in an ascus. Pycnidia not observed.

Etymology: The epithet refers to the host genus.

Distribution and ecology: The new *Stigmidium* species is known from the type locality on Pico, in the west of the island *ca* 3 km from the southwest coast, an open place with scattered trees, at 700 m altitude. It grows abundantly on trunks of *Ilex* trees, growing on the thallus of *Pyrenula* sp.

Notes: So far, no *Stigmidium* species have been recorded from the host genus *Pyrenula* (Diederich *et al.* 2018). Some *Stigmidium* species have relatively comparable ascospores as in the new species, but these are mostly all much wider, up to *ca* 10 μm. Species with similar measurements of the ascospores are *Stigmidium degelii* R. Sant. (on *Degelia*) and *S. humidum* Pérez-Ortega, Halici et K. Knudsen (on *Thelenella muscorum*). A species with practically the same

length of ascospores, (14–)14.5–18(–21) μm, is *Stigmidium rouxianum* Calatayud et Triebel, but they are wider (5–)6–7(–8) μm and the ascomata are smaller (80–200 μm) than in the new species, furthermore it grows on *Acarospora cervina* A. Massal. (Calatayud and Triebel 2003).

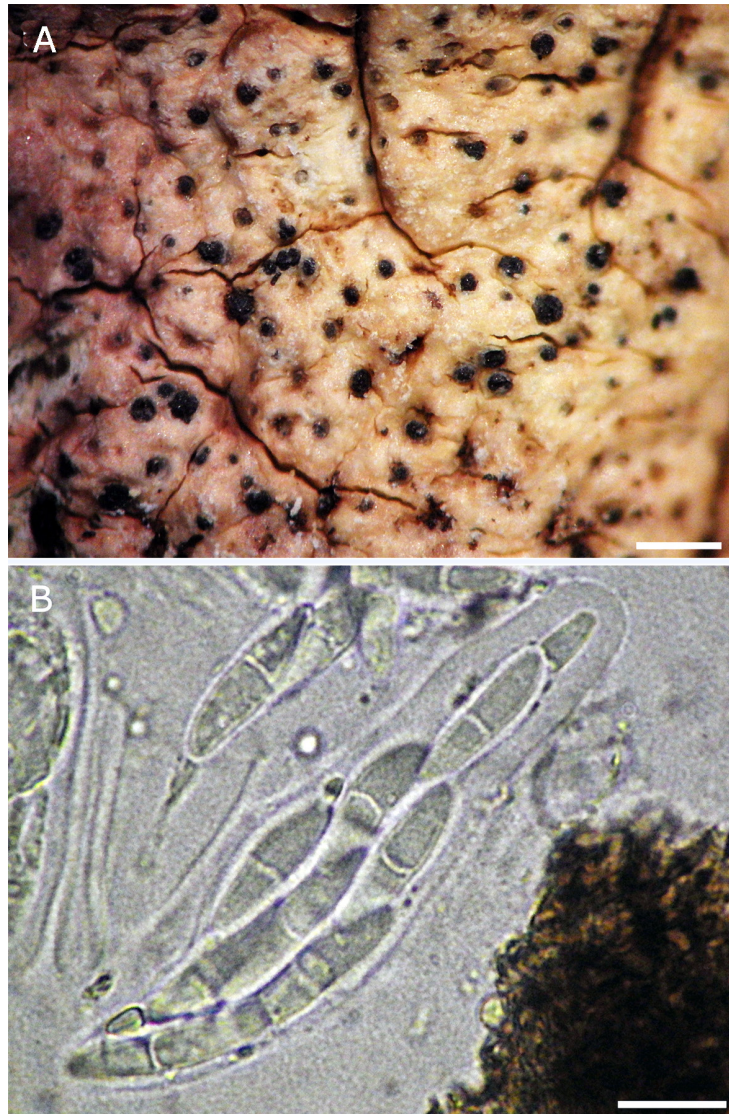

Fig. 5. Stigmidium pyrenulae (holotype): A = habitus (scale = 0.5 mm); B = ascospores in ascus (scale = 10 μm)

SPECIES LIST

Abrothallus hypotrachynae Etayo et Diederich – Loc. 24 on *Cryptomeria*, on *Hypotrachyna*, 57063.

Alyxoria ochrocheila (Nyl.) Ertz et Tehler – Loc. 24 on tree fern, 57100.

Anisomeridium macropycnidiae van den Boom – Loc. 2 on *Pittosporum*, 56603.

Arthonia atra (Pers.) A. Schneid. – Loc. 13 on *Podranea*, 56796.

Arthonia digitatae Hafellner – Loc. 5 on *Ilex*, on *Cladonia*, 56653.

**Arthonia diploiciae* Calat. et Diederich – Loc. 10 on stone of wall, on *Diploicia canescens*, 56732.

Arthonia ilicina T. Taylor – Loc. 8 on *Frangula*, 56704; Loc. 9 on *Ilex*, 56712.

**Arthonia leucopellaea* (Ach.) Almq. – Loc. 24 on *Thuja*, 57081; on *Quercus*, 57097.

Arthonia stellaris Kremp. – Loc. 10 on *Dracaena*; Loc. 11 on *Dracaena*, 56746; on *Thuja*, 56759; Loc. 24 on *Thuja*, 57084; on *Quercus*, 57098.

Arthonia thelotrematis Coppins – Loc. 9 on *Ilex*, on *Thelotrema lepadinum*, 56728.

**Asteroglobulus pyramidalis* (Etayo) Diederich – Loc. 3 on *Erica*, on *Hypotrachyna*, 56612.

Bacidia arceutina (Ach.) Arnold – Loc. 1 on *Yucca*, 56568; Loc. 24 on tree, 57086, 57087; Loc. 30 on tree, 57160, 57161.

Bacidina chloroticula (Nyl.) Vězda et Poelt – Loc. 23 on wood of fence post, 57030.

Biatora britannica Printzen, Lumbsch et Orange – Loc. 1 on *Camellia*, 56561.

Biatoropsis usnearum Räsänen s. l. – Loc. 3 on *Erica*, 56629; Loc. 23 on *Erica*, 57048.

Blastenia crenularia (With.) Arup, Søchting et Frödén – Loc. 33 on volcanic rock, 57212.

Buellia mediterranea Giralt – Loc. 3 on *Erica*, 56625; Loc. 19 on cone of *Pinus*, 56915.

Byssoloma fuscum van den Boom – Loc. 6 on *Erica*, 56675; Loc. 17 on *Erica*, 56855; on *Juniperus*, 56848.

Byssoloma maderense Breuss – Loc. 24 on tree fern, 57101.

Byssoloma marginatum (Arnold) Sérus. – Loc. 7 on *Erica* (on moss), 56696.

Canoparmelia caroliniana (Nyl.) Elix et Hale – Loc. 9 56717; Loc. 24 57064, 57079; all on *Cryptomeria*.

Capronia hypotrachynae Etayo et Diederich – Loc. 15 on *Juniperus*, on *Hypotrachyna*, 56816. Recently recorded from Terceira by Etayo (2018).

Chionosphaera apobasidialis D. E. Cox – Loc. 15 on *Juniperus*, on *Hypotrachyna*, 56832.

**Chrysothrix xanthina* (Vain.) Kalb – Loc. 1 on *Cryptomeria*, 56546; Loc. 30 on *Pinus*, 57164.

Cladonia didyma (Fée) Vain. – Loc. 9 on *Metrosideros*, 56722; on *Cryptomeria*, 56719; Loc. 15 on *Juniperus*, 56828; Loc. 20 on *Pinus*, 56941.

Cladonia squamosa (Scop.) Hoffm. var. *subsquamosa* (Nyl. ex Leight.) Vain. – Loc. 3 on *Erica*, 56616.

Coccocarpia erythroxyli (Spreng.) Swinscow et Krog – Loc. 33 on volcanic rock, 57217.

Coccocarpia palmicola (Spreng.) Arv. et D. J. Galloway – Loc. 15 on *Juniperus*, 56817; Loc. 19 on *Erica*, 56921.

Coenogonium luteum (Dicks.) Kalb et Lücking – Loc. 30 on *Eucalyptus*, 57157.

Coenogonium tavaresianum (Vězda) Lücking, Aptroot et Sipman – Loc. 11 *Cryptomeria*, 56747.

Collema furfuraceum (Arnold) Du Rietz – Loc. 25 on *Araucaria*, 57109.

Coniocarpon cinnabarinum DC. – Loc. 1 on *Pittosporum*, 56547.

Diploicia canescens (Dicks.) A. Massal. subsp. *australasica* – Loc. 10 on stone of wall, 56734.

Endohyalina ericina (Nyl.) Giralt, van den Boom et Elix – Loc. 1 on *Cryptomeria*, 56548.

Enterographa hutchinsiae (Leight.) A. Massal. – Loc. 1 on *Camellia*, 56564.

Fellhanera bouteillei (Desm.) Vězda – Loc. 17 on *Erica*, 56853.

Flavoparmelia caperata (L.) Hale – Loc. 26 on *Erica*, 57124, 57129.

Fulvophyton sorediatum (Sparrius, L., P. James et M. A. Allen) Tehler et van den Boom – Loc. 33 on volcanic rock, 57208.

Glyphis cicatricosa Ach. – Loc. 1 on *Castanea*, 56586; Loc. 24 on *Cryptomeria*, 57083; on tree, 57085.

Herteliana gagei (Sm.) J. R. Laundon – Loc. 31 on stone of wall, 57185.

Hypotrachyna rockii (Zahlbr.) Hale – Loc. 24 on *Castanea*, 57103; Loc. 26 on *Erica*, 57115; Loc. 27 on *Cryptomeria*, 57142.

Jamesiella anastomosans (P. James et Vězda) Lücking, Sérus. et Vězda – Loc. 3 on *Erica*, 56621; Loc. 7 on *Erica*, 56685; Loc. 14 on *Erica*, 56812; Loc. 17 on *Erica* (fertile), 56863; Loc. 31 on *Erica*, 57165.

**Japewiella tavaresiana* (H. Magn.) Printzen – Loc. 3 on *Erica*, 56635.

Lecania naegelii (Hepp) Diederich et van den Boom – Loc. 11 on *Thuja*, 56761.

Lecanora albella (Pers.) Ach. – Loc. 13 on *Podranea*, 56795; Loc. 18 on cone of *Pinus*, 56914.

Leptogium brebissonii Mont. – Loc. 21 on *Platanus*, 56955; Loc. 24 on *Acer*, 57070.

Leucodermia leucomelos (L.) Kalb – Loc. 31 on stone of wall, 57187.

Lichenoconium erodens M. S. Christ. et D. Hawksw. – Loc. 3 on *Laurus*, on crust, 56609.

**Llimonaea sorediata* van den Boom, Brand et Elix – Loc. 10 on volcanic rock, 56743.

Lobaria immixta Vain. – Loc. 8 on *Ilex*, 56703; Loc. 19 on *Erica*, 56927.

Micarea alabastrites (Nyl.) Coppins – Loc. 21 on *Cryptomeria*, 56946; Loc. 24 on *Cryptomeria*, 57093.

Micarea prasina Fr. s. l. – Loc. 11 on *Cryptomeria*, on *Parmotrema reticulatum*, 56751.

Micarea synotheoides (Nyl.) Coppins – Loc. 21 on *Cryptomeria*, 56947.

Mycoblastus alpinus (Fr.) Th. Fr. ex Hellb. – Loc. 5 on *Ilex*, 56652; Loc. 15 on *Juniperus*, 56830; Loc. 18 on *Juniperus* (fertile), 56877; Loc. 19 on *Erica*, 56920.

Mycoporum antecellens (Nyl.) R. C. Harris – Loc. 3 on *Erica*, 56620; Loc. 6 on unid. shrub, 56671; on *Erica*, 56674; Loc. 22 on *Frangula*, 57009.

Nephroma laevigatum Ach. – Loc. 21 on *Platanus*, 56950.

Normandina pulchella (Borrer) Nyl. – Loc. 1 on *Thuja*, 56579; Loc. 24 on *Acer*, 57069; Loc. 31 on *Erica*, 57174.

Opegrapha foreaui (Moreau) Hafellner et R. Sant. – Loc. 3 on *Laurus*, on *Heterodermia*, 56615.

Parmeliella parvula P. M. Jørg. – Loc. 23 on *Pinus*, 57025.

Parmelinopsis horrescens (Taylor) Elix et Hale – Loc. 24 on *Cryptomeria*, 57075.

Peltigera hymenina (Ach.) Delise ex Duby – Loc. 23 on soil, 57032; Loc. 28 on *Cryptomeria*, 57150; Loc. 29 on soil, 57156.

**Peltigera neckeri* Hepp – Loc. 7 on *Erica*, 56680.

**Peltigera polydactylon* (Neck.) Hoffm. – Loc. 19 on *Ilex*, 56929.

Pertusaria pustulata (Ach.) Duby – Loc. 1 on *Yucca*, 56572.

Phaeographis inusta (Ach.) Müll. Arg.– Loc. 1 on *Camellia*, 56566, on tree, 56583, on *Castanea*, 56587; Loc. 22 on *Frangula*, 57017; Loc. 24 on *Thuja*, 57071, on *Quercus*, 57099.

Physcia atrostriata Moberg – Loc. 25 on *Araucaria*, 57112.

Physcia erumpens Moberg – Loc. 9 on *Ilex*, 56726.

Physcia sorediosa (Vain.) Lynge – Loc. 30 on tree, 57163.

Physcia tribacioides Nyl. – Loc. 31 on *Erica*, 57168.

Placynthiella dasaea (Stirt.) Tønsberg – Loc. 5 on *Ilex*, 56659.

Platismatia glauca (L.) W. L. Culb. et C. F. Culb. – Loc. 26 on *Erica*, 57121.

Polychidium dendriscum (Nyl.) Henssen – Loc. 21 on *Platanus*, 56951.

**Polycoccum microsticticum* (Leight.) Arnold – Loc. 3 on *Erica*, 56630, on crust.

Porina aenea (Wallr.) Zahlbr. – Loc. 31 on tree, 57179.

**Porina coralloidea* P. James – Loc. 31 on *Erica*, 57171.

Porina leptalea (Durieu et Mont.) A. L. Sm. – Loc. 24 on *Cryptomeria*, 57074, 57094, 57095.

Pseudocyphellaria aurata (Ach.) Vain. – Loc. 21 on *Platanus*, 56953.

Pseudopyrenula diluta (Fée) Müll. Arg. – Loc. 6 on shrub, 56673; Loc. 9 on *Ilex*, 56725.

Pyrenula dermatodes (Borrer) Schaer. – Loc. 24 on *Thuja*, 57073; Loc. 28 on *Pinus*, 57152.

Pyrenula hibernica (Nyl.) Aptroot et Etayo – Loc. 7 on *Ilex*, 56682 (?); Loc. 19 on *Ilex*, 56932.

Pyrenula laevigata (Pers.) Arnold – Loc. 1 on *Camellia*, 56560, 56591, 56596; Loc. 2 on *Myrica*, 56599.

Pyrenula macrospora (Degel.) Coppins et P. James – Loc. 24 on tree, 57088.

Ramalina azorica Aptroot et Schumm – Loc. 33 on volcanic rock, 57215.

Ramalina peruviana Ach. – Loc. 11 on *Thuja*, 56765.

Ramalina siliquosa (Huds.) A. L. Sm. – Loc. 10 on volcanic rock, 56737; Loc. 33 on volcanic rock, 57210.

Rinodina dolichospora Malme – Loc. 11 on *Thuja*, 56753.

Roccella allorgei Abbayes – Loc. 10 on volcanic rock, 56741; Loc. 33 on volcanic rock, 57221.

Roccella maderensis (J. Steiner) Follmann – Loc. 33 on volcanic rock, 57220.

Roccella tuberculata Vain. – Loc. 33 on volcanic rock, 57216.

Roccellographa circumscripta (Taylor) Ertz et Tehler – Loc. 10 on volcanic rock, 56744; Loc. 33 on volcanic rock, 57213.

Roselliniella papuana Diederich – Loc. 26 on *Erica*, 57119; Loc. 27 on *Cryptomeria*, 57141, both on *Usnea*.

Schismatomma graphidioides (Leight.) Zahlbr. – Loc. 13 on *Podranea*, 56797, 56798.

**Scoliciosporum gallurae* Vězda et Poelt – Loc. 14 on *Erica*, 56810, 56811.

Scoliciosporum umbrinum (Ach.) Arnold – Loc. 22 on *Frangula*, 57011.

Scytinium teretiusculum (Wallr.) Otálora, P. M. Jørg. et Wedin – Loc. 11 on *Thuja*, 56756.

**Skyttea lecanorae* Diederich et Etayo – Loc. 14 on *Erica*, on *Lecanora farinaria*, 56814.

Skyttea nitschkei (Körb.) Sherwood, D. Hawksw. et Coppins – Loc. 3 on *Erica*, on *Thelotrema*, 56623.

Solenopsora holophaea (Mont.) Samp. – Loc. 10 on volcanic rock, 56738.

Sticta sylvatica (Huds.) Ach. – Loc. 18 on shrub, 56912.

Stigmidium triebelae Etayo – Loc. 33 on volcanic rock, on *Parmotrema reticulatum*, 57222.

Syncesia myrticola (Fée) Tehler – Loc. 1 on tree, 56584; Loc. 30 on *Pittosporum*, 57158.

Teloschistes flavicans (Sw.) Norman – Loc. 11 on *Thuja*, 56762; Loc. 23 on *Erica*, 57047; Loc. 31 on stone of wall, 57188.

Thelotrema laurisilvae Lücking et Breuss – Loc. 1 on *Castanea*, 56588; on *Acmena*, 56574; Loc. 31 on *Pittosporum*, 57181.

Thelotrema lepadinum (Ach.) Ach. – Loc. 22 on *Frangula*, 57018; Loc. 24 on *Thuja*, 57080; Loc. 26 on *Erica*, 57122; Loc. 27 on *Cryptomeria*, 57146; Loc. 28 on *Pinus*, 57155; Loc. 31 on tree, 57178; on *Pittosporum*, 57183.

Trapelia corticola Coppins et P. James – Loc. 17 on *Juniperus*, 56847; Loc. 21 on *Cryptomeria*, 56943.

Trapeliopsis granulosa (Hoffm.) Lumbsch – Loc. 9 on *Cryptomeria*, 56715.

Tremella parmeliarum Diederich – Loc. 3 on *Laurus*, 56614; on *Erica,* 56638; both on *Parmotrema.*

Xanthoparmelia conspersa (Ehrh. ex Ach.) Hale – Loc. 33 on volcanic rock, 57209.

*

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