Plant and Fungal Systematics 65(1): 120–130, 2020
DOI: https://doi.org/10.35535/pfsyst-2020-0006

ISSN 2544-7459 (print)
ISSN 2657-5000 (online)

Ikaeria serusiauxii, a new *Caloplaca*-like lichen from Macaronesia and mainland Portugal, with a lichen checklist for Porto Santo

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Article info
Received: 12 Sept. 2019
Revision received: 22 Oct. 2019
Accepted: 4 Nov. 2019
Published: 2 Jun. 2020

Associate Editor
Nicolas Magain

Abstract. The new species *Ikaeria serusiauxii* (*Teloschistaceae*, lichenized *Ascomycetes*) is described from the Madeira Archipelago, Canary Islands and continental Portugal. It is a crustose lichen on twigs and branches of trees and shrubs in xerophytic maritime vegetation. Superficially it is similar to *Caloplaca cerina* and *C. haematites*, from which it differs by the often black apothecium margin, very thick spore septa, black pycnidium ostioles, and the presence of the pigment *Cinereorufa*-green instead of *Sedifolia*-grey. ITS sequences suggest *Ikaeria aurantiellina* (syn. *Caloplaca aegatica*) as the closest relative. Added is a preliminary lichen checklist for Porto Santo (Madeira Archipelago, Macaronesia).

Key words: Taxonomy, lichens, diversity, island biology

Introduction

The Madeira Archipelago, one of the island groups of Macaronesia, is situated in the Atlantic Ocean some 500 km off the shore of NW Africa. Politically it belongs to Portugal. Like the Canary Islands, it has a dry warm climate except where higher mountains cause increased precipitation. During a visit to Porto Santo, the second largest island of the Madeira Archipelago, for a lichen mapping project (Sparrius et al. 2017), an unusual *Caloplaca*-like, epiphytic lichen showed up frequently on shrubs and trees, which somewhat resembled *C. cerina* or *C. haematites*. Morphological and macromolecular analyses showed it to be an undescribed species, which is treated below. Further results of this expedition are presented at https://archive.bgbm.org/sipman/Zschackia/PortoSanto/genuslist.htm, and a preliminary checklist for Porto Santo is presented below (Table 1).

Material and methods

Specimens were studied with a stereomicroscope and a compound microscope in tap-water mounts. ITS sequences were generated by Alvalab (Spain). The sequences were analysed using https://www.ebi.ac.uk/Tools/msa/muscle/ with standard settings and http://iqtree.cibiv.univie.ac.at/ (Trifinopoulos et al. 2016) with standard settings and sequence type = DNA (accessed 18 June 2019). Branch support values were obtained with ultrafast bootstrap (Hoang et al. 2018) implemented in IQ-TREE (Nguyen et al. 2015).

Vouchers are deposited in B, BR, M, MADJ and herb. van den Boom.

Results and discussion

For complete documentation of the new species, ITS sequences were generated. These gave a preliminary view of the affinities of the new species. A BLAST search in Genbank in 2017 gave the surprising result that the closest relatives were in the genus *Lecidea*. A repeated BLAST search in 2019 suggested an affinity with the genus *Ikaeria*, which was published meanwhile by Kondratyuk et al. (2017). It comprises the single species *Ikaeria aurantiellina*, based on samples from Tenerife, Canary Islands. The genus was found to belong to the subfamily *Teloschistoideae* as sister to the genus *Yoshimuria*, and not to the *Caloplacoideae* or *Xanthorioideae* where most crustose '*Caloplaca*' species in Europe and the Mediterranean belong.

Following these suggestions, a comparison of the new species with putative relatives was made. ITS sequences, mostly downloaded from Genbank, were aligned with *Megalospora*, *Brigantiaea* and *Letrouitia* as outgroups, with *Caloplaca cerina* and *C. haematites*

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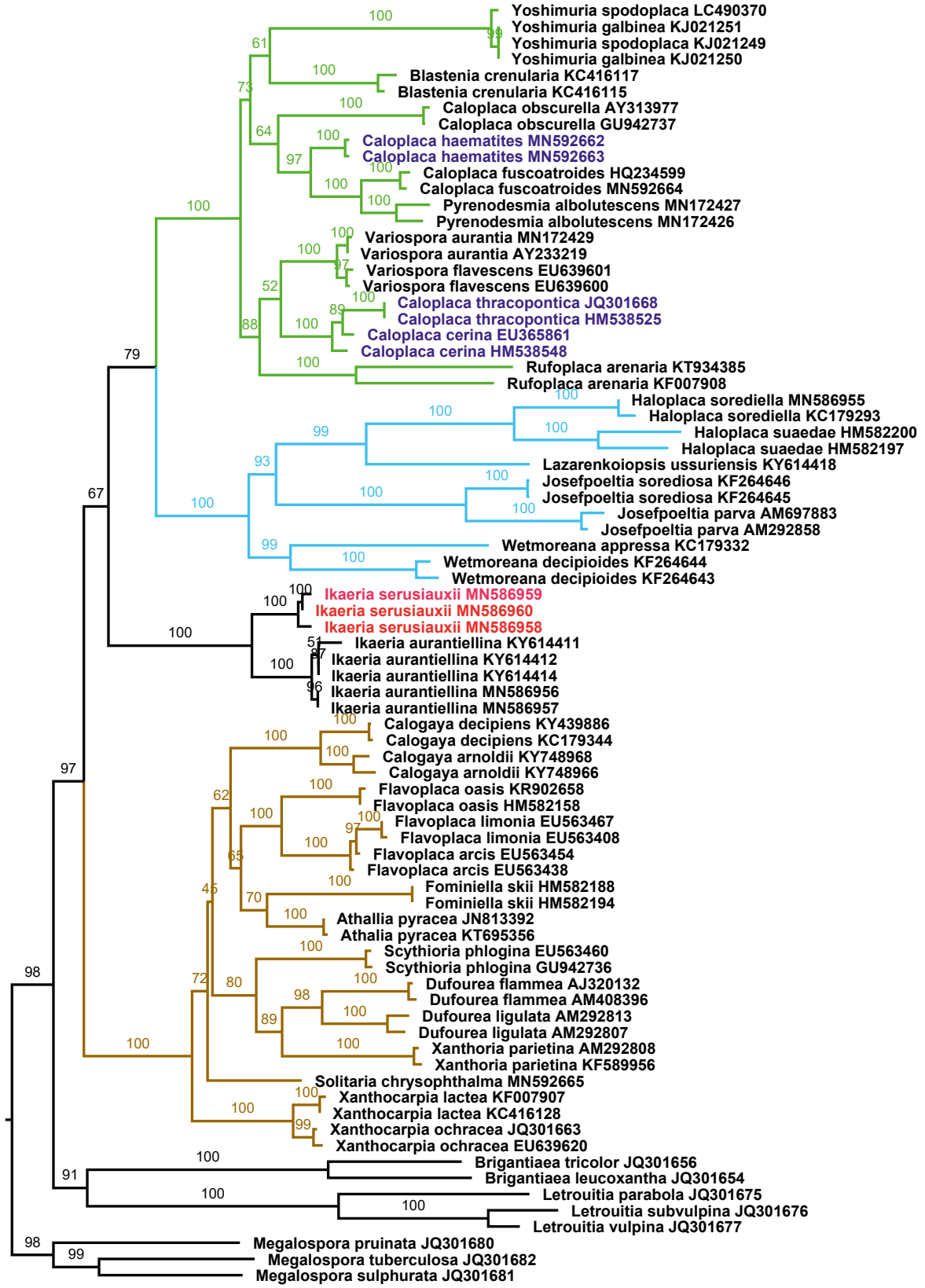

Figure 1. Phylogenetic tree from ITS sequences, with UFBootstrap values, of *Ikaeria serusiauxii* and selected *Teloschistaceae*. *I. serusiauxii* appears not closely related to *Caloplaca cerina* or *C. haematites* (blue) and falls outside the most frequent subfamilies in Macaronesia and Europe, i.e. *Caloplacoideae* (green clade) and *Xanthorioideae* (brown clade). Its closest relative is *I. aurantiellina* (black), which is included in *Teloschistoideae* (blue clade) in multilocus trees. Terminal bootstrap values omitted.

as potential relatives, with the genus *Ikaeria*, and with selected representatives of the three main groups of *Teloschistaceae*, the subfamilies *Xanthorioideae*, *Caloplacoideae* and *Teloschistoideae* (Arup et al. 2013). The resulting tree (Fig. 1) shows that the new species is clearly distinct from *C. cerina* and *C. haematites*, and that it has *Ikaeria aurantiellina* as the closest relative. Therefore the new species is included in the genus *Ikaeria*.

From Porto Santo, where the new species was recognized first, few lichen species have been reported so far. Krog & Østhagen (1980) and Krog (1990) reported *Ramalina* species, and Haugan (1992) a species of *Anzia*. These authors discovered remarkable lichen endemism on the island. Short lists of additional species were published by Follmann (1990), Carvalho et al. (2008) and Sparrius et al. (2017). Some recent monographers included material from the island, in particular Timdal (1992) on *Toninia*. The presented checklist (Table 1) is based mainly on the more easily recognizable lichen species observed during our mapping fieldwork. An attempt was made to study some groups in more detail, but the example of *Ikaeria serusiauxii* showed that a full evaluation requires more effort than we can invest currently. Therefore we are using the opportunity to publish all data collected so far in a checklist, including information on whether TLC was done, and we release all newly generated ITS sequences, including for groups for which no conclusive taxonomy is settled yet.

Ikaeria serusiauxii Sipman, sp. nov. (Figs 2–3)

MycoBank MB 833026

Diagnosis: similar to *Caloplaca cerina* in its anthraquinone-free thallus and apothecia with orange discs and often grey margin, but differing in having black pycnidium ostioles, thick ascospore septa, and the presence of the pigment Cinereorufa-green instead of *Sedifolia*-grey.

Type: Portugal, Madeira Islands, Porto Santo: E part, lower slopes N of Pico do Facho; ~350 m; 33°05.2′N, 16°19.3′W; epiphytes on fallen *Pinus* trees on slope; 2 March 2016; H. Sipman 62971 (B 60 0200928 – holotype; MADJ – isotype). ITS sequence: MN586960; LSU: MN586916: SSU: MN586910.

Description. Thallus continuous, ~1–3 cm wide, grey, in shade with a greenish or slightly brownish tinge, not pruinose, smooth and slightly glossy, ~0.05 mm thick, not sorediate or blastidiate, flat or slightly warty with low warts 0.1–0.2 mm wide; prothallus black, visible along the thallus margins and on abraded spots; cortex 10–20 µm thick, prosoplectenchymatous, composed of periclinal hyphae; algal layer ~30–50 µm thick, discontinuous; medulla absent. Apothecia zeorine, abundant,

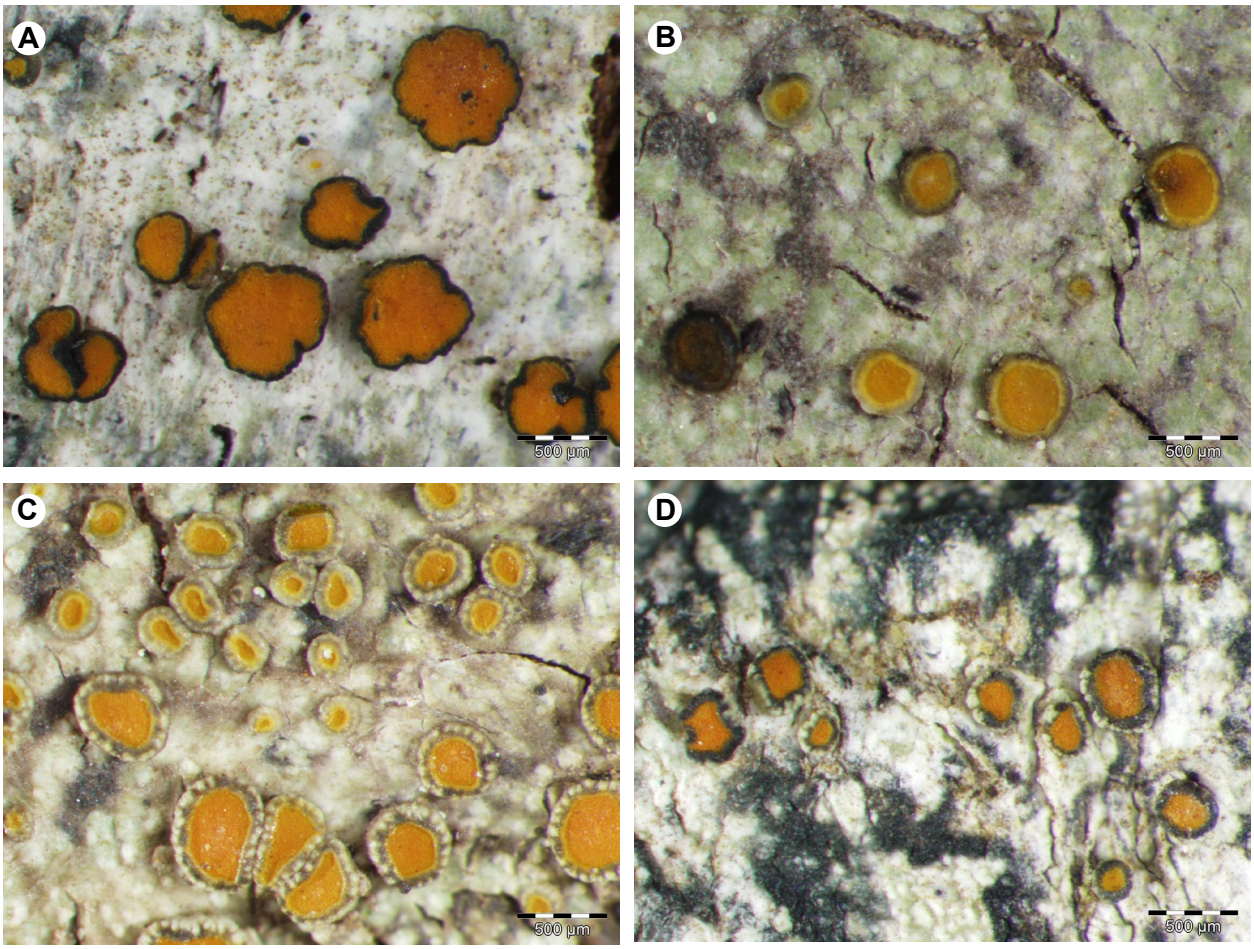

Figure 2. *Ikaeria serusiauxii*. A – apothecia in full light, with completely black margins (Sipman 62798); B – apothecia in shade, with grey margin (Sipman 62802); C – apothecia in shade, with grey-crenulated margin (Sipman 62957); D – apothecia in full light, with black-crenulated margin (Sipman 62971, holotype). Note black prothallus visible in abraded parts of thallus. Scales: A–D = 500 µm.

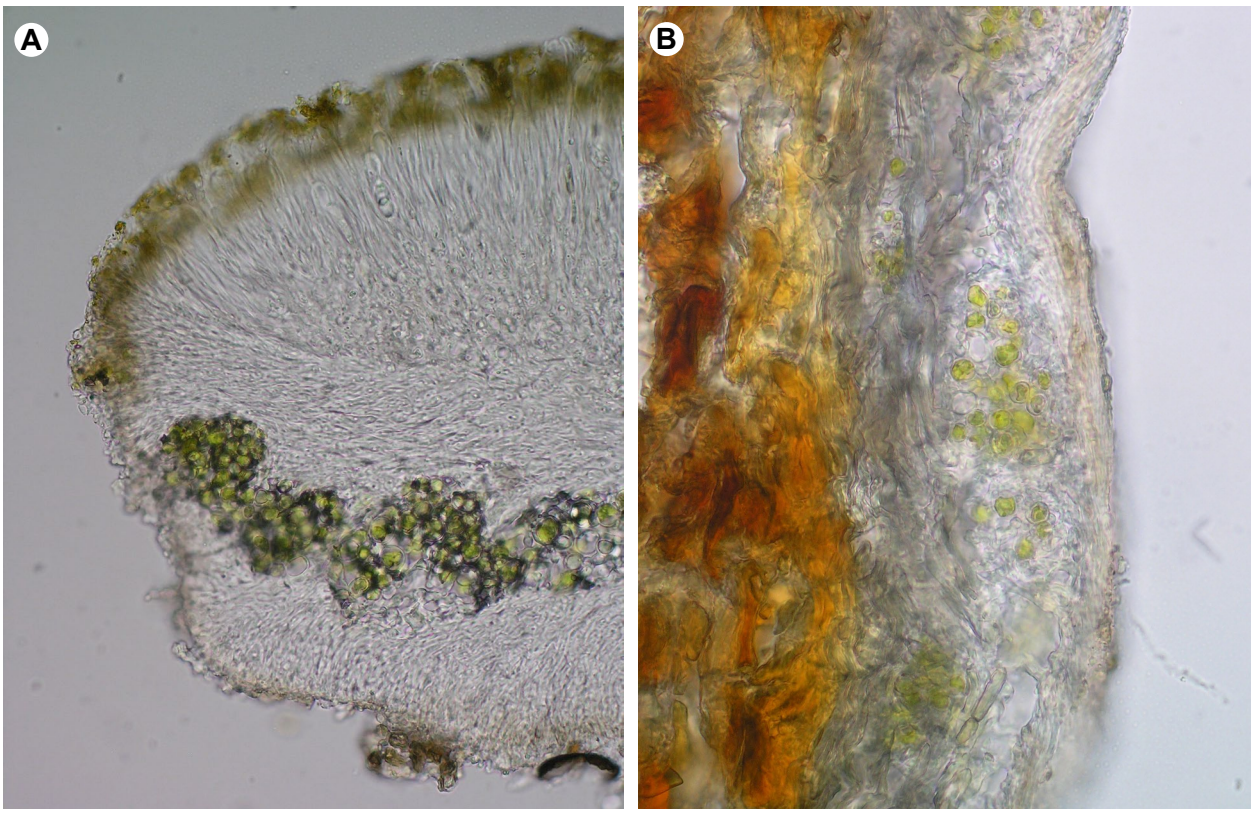

Figure 3. Anatomy of *Ikaeria serusiauxii*. A – apothecium section showing prosoplectenchymatic proper excipulum and cortex; B – thallus section showing thin, prosoplectenchymatic cortex and absence of medulla. Scale: large algal cells in A and B.

~0.5–0.8 mm in diam., when wider mostly subdivided into a few marginate discs forming a convex group, sessile, non-pruinose; disc flat to slightly convex, orange; margin of variable color ranging from completely black to greenish grey, more commonly intermediate, greenish grey with black spots in marginal crenulations, raised above the disc when young, somewhat reduced in old apothecia; true exciple and hypothecium prosoplectenchymatous, ~10–30 µm thick; thalline exciple ~100 µm thick; cortical layer ~50 µm thick below, thinner laterally, composed of dense, branching, anticlinal hyphae; algal layer ~50 µm, interrupted, with *Trebouxia*-like algae ~6–10 µm in diam.; epihymenium orange, granular; hymenium 50–60 µm thick, hyaline; paraphyses simple for most of their length, ~2 µm wide, apically slightly swollen to ~3 µm and dichotomously branched a few times; ascospores polarilocular, ellipsoid, ~12–16 × 6–8 µm; septum 8–12 µm wide; ratio of septum width to spore length 0.6–0.75. Pycnidia scattered, rather sparse, immersed with ±raised black ostiole; conidia bacilliform, ~3.5 × 0.8 µm.

Chemistry. Not tested by TLC; the black parts of the apothecia, the pycnidium ostiole and the prothallus contain dark olive-green pigment in the outer locules of the cortex, in K turning more greenish but persistent (Cinereorufa-green); the epithecium turning violet in K, releasing clouds of fine violet crystals (indet. anthraquinones); thallus and apothecium margin lack anthraquinones (K–).

Etymology. Named after Emmanuel Sérusiaux, our esteemed companion on expeditions in Papua New Guinea, who contributed significantly to the exploration of the lichen diversity of Macaronesia.

Distribution and ecology. The species is known from Macaronesia (Madeira Archipelago and Canary Islands) and from mainland Portugal (Algarve, Estremadura). Here it is found on twigs and branches of trees and shrubs in open, rather xerophytic vegetation, e.g. on *Euphorbia piscatoria*, but also on introduced *Cupressus* and *Pinus*. On Porto Santo it is fairly common at 350–400 m a.s.l. From the Madeira Island, so far two records are available, from 500–575 m a.s.l. The localities in mainland Portugal are close to the seashore.

Notes. *Caloplaca cerina* is the most likely species to be confused with *Ikaeria serusiauxii*, as it shares an anthraquinone-free, pale thallus, anthraquinone-free apothecium margins and yellow to orange-colored discs (Šoun et al. 2011). However, *I. serusiauxii* differs clearly from *C. cerina* s.l. by the black pycnidium ostioles, the presence of the pigment Cinereorufa-green, and the thick ascospore septa 8–12 µm wide instead of 5–8 µm (Fletcher & Laundon 2009). Another rather similar species in the Mediterranean, *Caloplaca haematites*, has, like *C. cerina*, an anthraquinone-free thallus, anthraquinone-free apothecium margins and often orange-coloured discs, but in full light the thallus is very dark, almost black, due to a different, grey, K+ violet pigment (*Sedifolia*-grey), and the discs are reddish; only in shade are the thallus greenish grey and the discs orange. Thus, *I. serusiauxii* is clearly distinct in full light by the thallus- and apothecium color, and by the presence of Cinereorufa-green, while

Table 1. Preliminary checklist of 221 lichenized fungi known from Porto Santo. Added are habitat (sax = on rock; ter = on soil; cor = corticolous), herbaria where vouchers are available, availability of TLC results, ITS sequences stored in Genbank, and references to published reports. Pictures of many species as well as some provisionally identified ones can be found on the website https://archive.bgbm.org/sipman/Zschackia/PortoSanto/genuslist.htm

Taxon	Habitat	Voucher	TLC	ITS sequences	Publications
Acarospora lavicola J. Steiner	sax	B, M	–	MN586918	Sipman & Aptroot (2019)
Acarospora veronensis A. Massal.	sax	B, M	–	MN586919	Sipman & Aptroot (2019)
Acrocordia salweyi (Leight. ex Nyl.) A. L. Sm.	sax	M	–	–	Sipman & Aptroot (2019)
Agonimia tristicula (Nyl.) Zahlbr.	cor	M	–	–	Sipman & Aptroot (2019)
Alyxoria ochrocheila (Nyl.) Ertz & Tehler	sax	M	–	–	Sipman & Aptroot (2019)
Alyxoria varia (Pers.) Ertz & Tehler	cor	B, M	–	–	Sipman & Aptroot (2019)
Amandinea pelidna (Ach.) Fryday & L. Arcadia	sax	B	–	–	Sipman & Aptroot (2019)
Amandinea sp.	sax	B	–	MN586920, MN586921	Sipman & Aptroot (2019)
Anzia centrifuga Haugan	sax	B, BR, M	–	–	Haugan (1992), Sparrius et al. (2017)
Arthonia calcarea (Turner ex Sm.) Ertz & Diederich	sax	M	–	–	Sipman & Aptroot (2019)
Arthonia punctiformis Ach.	cor	B, M	–	–	Sipman & Aptroot (2019)
Aspiciliella portosantana Sipman & Zakeri	sax	B, BR, M	yes	MN586922, MN586923, MN586924	Zakeri et al. (2017)
Bacidia laurocerasi (Delise ex Duby) Zahlbr.	cor	M	–	–	Sipman & Aptroot (2019)
Bacidina arnoldiana (Körb.) V. Wirth & Vězda	sax	M	–	–	Sipman & Aptroot (2019)
Bactrospora thyrsodes (Stirt.) Llop & Van den Boom	sax	M	–	–	Sipman & Aptroot (2019)
Blastenia festivella (Nyl.) Vondrák	sax	B, M	–	MN586926, MN586927, MN586928, MN586929	Sipman & Aptroot (2019)
Buellia caloplacivora Llimona & Egea	sax	B	–	–	Sipman & Aptroot (2019)
Buellia dispersa A. Massal.	sax		–	–	Sparrius et al. (2017)
Buellia mediterranea Giralt	cor	B	–	–	Sipman & Aptroot (2019)
Buellia spuria (Schaer.) Anzi	sax	B, M	yes	MN586930	Follmann (1990) as *B. lactea*
Buellia stellulata (Taylor) Mudd	sax	B, M	–	–	Sipman & Aptroot (2019)
Buellia tesserata (Taylor) Mudd	sax	B	yes	MN586931, MN586932	Sipman & Aptroot (2019)
Caloplaca cf. *albolutescens* (Nyl.) H. Olivier	sax	B, M	–	MN586934	Sipman & Aptroot (2019)
Caloplaca cf. *ceracea* J. R. Laundon	sax	B, M	–	MN586925, MN586935	Sipman & Aptroot (2019)
Caloplaca cf. *flavovirescens* (Wulfen) Dalla Torre & Sarnth.	cor	B	–	MN586938, MN586937	Sipman & Aptroot (2019)
Caloplaca cf. *neotaurica* Vondrák, Khodos., Arup & Søchting	sax	B	–	MN586946, MN586933, MN586947, MN586948	Sipman & Aptroot (2019)
Candelariella vitellina (Hoffm.) Müll. Arg.	sax	B, BR, M	–	–	Follmann (1990)
Catillaria atomarioides (Müll. Arg.) H. Kilias	sax	M	–	–	Sipman & Aptroot (2019)
Catillaria chalybeia (Borrer) A. Massal.	sax	B, M	–	–	Sipman & Aptroot (2019)
Catillaria mediterranea Hafellner	Lichenicilous	B	–	–	Sipman & Aptroot (2019) on *Ramalina crispatula*, lower part of lobes
Catillaria minuta (Schaer.) Lettau	sax	M	–	–	Sipman & Aptroot (2019)
Chaenotheca furfuracea (L.) Tibell	cor	M	–	–	Sipman & Aptroot (2019)
Chrysothrix candelaris (L.) J. R. Laundon	sax, ter, cor	M	–	–	Sipman & Aptroot (2019)
Circinaria contorta (Hoffm.) A. Nordin, Savić & Tibell	sax	B, M	–	–	Sipman & Aptroot (2019)
Cladonia humilis (With.) J. R. Laundon	ter	B, M	–	–	Sipman & Aptroot (2019)
Cladonia macilenta Hoffm.	ter	M	–	–	Sipman & Aptroot (2019)
Cladonia microphylla Ahti & Aptroot	ter	B, M	yes	MN586949	Sipman & Aptroot (2019)
Cladonia peziziformis (With.) J. R. Laundon	ter	B, M	yes	–	Sipman & Aptroot (2019)
Cladonia ramulosa (With.) J. R. Laundon	ter	M	–	–	Sipman & Aptroot (2019)
Cladonia rangiformis Hoffm.	ter	B, M	yes	–	Sipman & Aptroot (2019)
Cladonia stereoclada Abbayes	ter	B, M	–	MN586950	Sipman & Aptroot (2019)
Clauzadea metzleri (Körb.)	sax	M	–	–	Meyer (2002), Clauzade & Cl. Roux ex D. Hawksw.
Clavascidium lacinulatum (Ach.) M. Prieto	ter	BR, M	–	–	Sipman & Aptroot (2019)
Cliostomum griffithii (Sm.) Coppins	sax, cor	B, BR, M	–	–	Sipman & Aptroot (2019)
Coccocarpia erythroxyli (Spreng.) Swinscow & Krog	sax	M	–	–	Sipman & Aptroot (2019)
Coenogonium luteum (Dicks.) Kalb & Lücking	cor	M	–	–	Sipman & Aptroot (2019)

Table 1. Continued.

Taxon	Habitat	Voucher	TLC	ITS sequences	Publications
Collema ryssoleum (Tuck.) A. Schneid.	sax	B, M	–	–	Sipman & Aptroot (2019)
Collemopsidium caesium (Nyl.) Coppins & Aptroot	sax	M	–	–	Sipman & Aptroot (2019)
Cresponea premnea (Ach.) Egea & Torrente	cor	B, M	–	–	Sipman & Aptroot (2019)
Crocodia aurata (Ach.) Link	cor	B, M	–	–	Sipman & Aptroot (2019)
Dimelaena radiata (Tuck.) Hale & W. L. Culb.		B	yes	–	Sipman & Aptroot (2019)
Diploicia canescens (Dicks.) A. Massal.	sax	B, BR, M	–	–	Sipman & Aptroot (2019)
Diploicia subcanescens (Werner) Hafellner & Poelt	sax	B, BR, M	–	–	Follmann (1990)
Diploschistes actinostomus (Ach.) Zahlbr.	sax	B, M	–	MN586951, MN586952, MN586953	Follmann (1990) as *D. caesioplumbeus*
Dirina cf. *ceratoniae* (Ach.) Fr.	cor	–	–	–	Follmann (1990), Sparrius et al. (2017)
Dirina insulana (Tav.) Tehler	sax	B, BR, M	–	–	Tehler et al. (2013), Follmann (1990) as *D. massiliensis*
Dirina paradoxa subsp. *africana* (Tehler) Tehler	cor	–	–	–	Sipman & Aptroot (2019)
Dirinaria applanata (Fée) D. D. Awasthi	sax	B	–	MN586954	Sipman & Aptroot (2019)
Enchylium tenax (Sw.) Gray	ter	BR, M	–	–	Sipman & Aptroot (2019)
Endocarpon pusillum Hedw.	ter	B	–	–	Sipman & Aptroot (2019)
Endohyalina ericina (Nyl.) Giralt, van den Boom & Elix	cor	B, M	–	MN587027, MN587028	Sipman & Aptroot (2019)
Enterographa hutchinsiae (Leight.) A. Massal.	sax	B	–	–	Sipman & Aptroot (2019)
Epiphloea terrena (Nyl.) Trevis.	ter	B, M	–	–	Sipman & Aptroot (2019)
Flavoplaca cf. *maritima* (B. de Lesd.) Arup, Frödén & Søchting	sax	B	–	MN586941, MN586939, MN586940, MN586936, MN586942, MN586943, MN586944, MN586945	Sipman & Aptroot (2019)
Fulgensia desertorum (Tomin) Poelt	ter		–	–	Follmann (1990)
Fulvophyton sorediatum (Sparrius, P. James & M. A. Allen) Tehler & van den Boom	sax	B, M	–	–	Sparrius et al. (2017)
Gyalecta schisticola Werner	sax, ter	B, M	–	–	Sipman & Aptroot (2019)
Haloplaca sorediella (Arup) Arup, Frödén & Søchting	sax, cor	B	–	MN586955	Sipman & Aptroot (2019)
Heppia conchiloba Werner	ter	M	–	–	Sipman & Aptroot (2019)
Heterodermia leucomelos (L.) Poelt	sax, ter, cor	B, BR, M	yes	–	Carvalho et al. (2008)
Hyperphyscia adglutinata (Flörke) H. Mayrhofer & Poelt	cor	BR	–	–	Sipman & Aptroot (2019)
Ikaeria serusiauxii Sipman	cor	B	–	MN586958, MN586959, MN586960	Sipman & Aptroot (2019)
Ikaeria aurantiellina (Harm.) S. Y. Kondr., Upreti & Hur (syn. Caloplaca aegatica Giralt, Nimis & Poelt)	cor	B	–	MN586957, MN586956	Sipman & Aptroot (2019)
Lecania cuprea (A. Massal.) Van den Boom & Coppins	sax	M	–	–	Sipman & Aptroot (2019)
Lecania naegelii (Hepp) Diederich & Van den Boom	cor	M	–	–	Sipman & Aptroot (2019)
Lecania nigra van den Boom & Ertz	sax	B	–	–	Sipman & Aptroot (2019)
Lecania sylvestris (Arnold) Arnold	sax	M	–	–	Sipman & Aptroot (2019)
Lecania turicensis (Hepp) Müll. Arg.	sax	BR, M	–	–	Sipman & Aptroot (2019)
Lecanographa dialeuca (Cromb.) Egea & Torrente	sax	B, BR, M	–	–	Sparrius et al. (2017)
Lecanora campestris (Schaer.) Hue	sax	M	yes	MN586965	Sipman & Aptroot (2019)
Lecanora confusa Almb.	cor	B, M		–	Follmann (1990)
Lecanora gangaleoides Nyl.	sax	M	yes	–	Sipman & Aptroot (2019)
Lecanora cf. *hybocarpa* (Tuck.) Brodo	cor	B, M	yes	MN586968, MN586969, MN586970	Sipman & Aptroot (2019)
Lecanora cf. *oreinoides* (Körb.) Hertel & Rambold	sax	B	yes	MN586966, MN586967	Sipman & Aptroot (2019)
Lecanora cf. *praepostera* Nyl.	sax	B, M	yes	MN586972, MN586971, MN586973	Sipman & Aptroot (2019)
Lecanora sulphurella Hepp	sax	B, BR, M	–	–	Follmann (1990)
Lecanora sp. 1	sax	B	yes	MN586961, MN586962	Sipman & Aptroot (2019)

Table 1. Continued.

Taxon	Habitat	Voucher	TLC	ITS sequences	Publications
Lecanora sp. 2	sax	B	yes	MN586974	Sipman & Aptroot (2019)
Lecanora sp. 3	sax	B, M	yes	MN586963, MN586964	Sipman & Aptroot (2019)
Lecidea sarcogynoides Körb.	sax	B, BR, M	–	–	Sipman & Aptroot (2019)
Lecidella cf. *elaeochromoides* (Nyl.) Knoph & Hertel	sax	B	–	MN586975, MN586976	Sipman & Aptroot (2019)
Lecidella cf. *meiococca* (Nyl.) Leuckert & Hertel	sax	B	–	MN586979	Sipman & Aptroot (2019)
Lecidella scabra (Taylor) Hertel & Leuckert	sax	M	–	–	Sipman & Aptroot (2019)
Lecidella sp.	sax	B	–	MN586977, MN586978	Sipman & Aptroot (2019)
Lepra amara (Ach.) Hafellner	cor	B	yes	–	Sipman & Aptroot (2019)
Lepra corallina (L.) Hafellner	–	photo M. Vervoort	–	–	Sipman & Aptroot (2019)
Lepra monogona (Nyl.) Hafellner	sax	photo M. Vervoort	–	–	Sipman & Aptroot (2019)
Lepra teneriffensis (Vain.) Hafellner	sax	B, M	yes	–	Sparrius et al. (2017) as *Pertusaria excludens*
Lepra trachythallina (Erichsen) Lendemer & R. C. Harris	cor	B, M	yes	–	Sipman & Aptroot (2019)
Lepraria maderensis Kukwa & Flakus	sax	B	yes	–	Sipman & Aptroot (2019)
Leprocaulon microscopicum (Vill.) Gams	sax, ter	B, M	–	–	Sipman & Aptroot (2019)
Leptogium teretiusculum (Flörke ex Wallr.) Arnold	sax, ter	B, M	–	–	Sipman & Aptroot (2019)
Lobaria macaronesica C. Cornejo & Scheid.	sax	B, M	–	–	Carvalho et al. (2008) as *L. pulmonaria*
Lobothallia recedens (Taylor) A. Nordin, Savić & Tibell	sax on *Aspiciliella portosantana*	B	–	MN586980	Sipman & Aptroot (2019)
Mycoporum sparsellum Nyl.	cor	M	–	–	Sipman & Aptroot (2019)
Myriolecis crenulata (Ach.) Śliwa, Zhao Xin & Lumbsch	sax	BR	–	–	Sipman & Aptroot (2019)
Myriolecis dispersa (Pers.) Śliwa, Zhao Xin & Lumbsch	sax	B, M	–	–	Sipman & Aptroot (2019)
Myriolecis hagenii (Ach.) Śliwa, Zhao Xin & Lumbsch	sax	BR, M	–	–	Sipman & Aptroot (2019)
Nephroma foliolatum P. James & F. J. White	sax, ter	M	–	–	Sipman & Aptroot (2019)
Nephroma laevigatum Ach.	ter	B	–	–	Sipman & Aptroot (2019)
Normandina pulchella (Borrer) Nyl.	sax, cor	M	–	–	Sipman & Aptroot (2019)
Ochrolechia incarnata (Leight.) Kukwa, Schmitt & Ertz	sax	B, BR, M	–	MN586981	Kukwa et al. (2018)
Opegrapha demutata Nyl.	sax	M	–	–	Sipman & Aptroot (2019)
Opegrapha lutulenta Nyl.	sax	B	–	–	Sipman & Aptroot (2019)
Opegrapha vulgata (Ach.) Ach.	cor	B, BR, M	–	–	Sipman & Aptroot (2019)
Orcularia insperata (Nyl.) Kalb & Giralt	cor	BR, M	–	–	Sipman & Aptroot (2019)
Pannaria rubiginosa (Thunb. ex Ach.) Delise	cor	M	–	–	Sipman & Aptroot (2019)
Pannaria tavaresii P. M. Jørg.	ter, cor	BR, M	–	–	Sipman & Aptroot (2019)
Paralecanographa grumulosa (Dufour) Ertz & Tehler	sax, lich	B	–	–	Sipman & Aptroot (2019)
Parmotrema perlatum (Huds.) M. Choisy	sax, cor	B, M	yes	–	Carvalho et al. (2008) as *P. chinense*
Parmotrema reticulatum (Taylor) M. Choisy	sax, cor	B, BR, M	yes	–	Carvalho et al. (2008) as *Rimelia cetrata*
Parmotrema tinctorum (Despr. ex Nyl.) Hale	sax, cor	B, BR, M	–	–	Sparrius et al. (2017)
Pectenia atlantica (Degel.) P. M. Jørg., L. Lindblom, Wedin & S. Ekman	sax, ter, cor	B, BR, M	–	–	Sipman & Aptroot (2019)
Peltula bolanderi (Tuck.) Wetmore	sax	M	–	–	Sipman & Aptroot (2019)
Peltula euploca (Ach.) Poelt	sax	B, BR, M	–	–	Sipman & Aptroot (2019)
Peltula obscurans (Nyl.) Gyeln.	sax, ter	B, M	–	–	Sipman & Aptroot (2019)
Peltula omphaliza (Nyl.) Wetmore	sax	M	–	–	Sipman & Aptroot (2019)
Pertusaria aleianta Nyl.	sax	B, BR, M	yes	–	Follmann (1990) as *P. gallica*, Sparrius et al. (2017) as *P. pluripuncta*
Pertusaria heterochroa (Müll. Arg.) Erichsen	cor	B	yes	–	Sipman & Aptroot (2019)

Table 1. Continued.

Taxon	Habitat	Voucher	TLC	ITS sequences	Publications
Physcia adscendens (Fr.) H. Olivier	cor	B		–	Sipman & Aptroot (2019)
Physcia erumpens Moberg	sax	B, M	–	–	Sipman & Aptroot (2019)
Placidium boccanum (Servít) Breuss	sax	BR, M	–	–	Sipman & Aptroot (2019)
Placidium squamulosum (Ach.) Breuss	ter	BR, M	–	–	Sipman & Aptroot (2019)
Placynthiella dasaea (Stirt.) Tønsberg	cor	M	–	–	Sipman & Aptroot (2019)
Placynthium nigrum (Huds.) Gray	sax	M	–	–	Sipman & Aptroot (2019)
Polysporina cyclocarpa (Anzi) Vězda	sax, ter	M	–	–	Sipman & Aptroot (2019)
Polysporina simplex (Taylor) Vězda	sax	B	–	–	Sipman & Aptroot (2019)
Porina curnowii A. L. Sm.	sax	B, M	–	–	Sipman & Aptroot (2019)
Porina leptospora (Nyl.) A. L. Sm.	cor	B	–	–	Sipman & Aptroot (2019)
Porpidia albocoerulescens (Wulfen) Hertel & Knoph	sax	M	–	–	Sipman & Aptroot (2019)
Porpidia crustulata (Ach.) Hertel & Knoph	sax	M	–	–	Sipman & Aptroot (2019)
Protoparmelia montagnei (Fr.) Sancho & A. Crespo	sax	B, M	–	MN586983, MN586982	Sipman & Aptroot (2019)
Protoparmeliopsis muralis (Schreb.) M. Choisy	sax	BR	–	–	Sipman & Aptroot (2019)
Psora decipiens (Hedw.) Hoffm.	ter		–	–	Follmann (1990)
Psorotichia murorum A. Massal.	sax	M	–	–	Sipman & Aptroot (2019)
Pyrenula chlorospila (Nyl.) Arnold	cor	M	–	–	Sipman & Aptroot (2019)
Pyrrhospora quernea (Dicks.) Körb.	cor	B, M	–	–	Sipman & Aptroot (2019)
Pyxine sorediata (Ach.) Mont.	sax	B, M	–	–	Sipman & Aptroot (2019)
Pyxine subcinerea Stirt.	sax	M	–	–	Sipman & Aptroot (2019)
Ramalina canariensis J. Steiner	cor	B	yes	–	Sipman & Aptroot (2019)
Ramalina chondrina J. Steiner	cor	B, M	yes	–	Sipman & Aptroot (2019)
Ramalina confertula Krog & Østh.	sax, cor	B, M	yes	–	Krog & Østhagen (1980), Follmann (1990), Sparrius et al. (2017)
Ramalina crispatula Despr. ex Nyl.	sax	B, M	yes	MN586989	Follmann (1990), Sparrius et al. (2017)
Ramalina decipiens Mont.	sax	B, M	yes	MN586991, MN586990, MN586993, MN586992, MN586994	Sérusiaux et al. (2010) as *R. subwebbiana*, Sparrius et al. (2017)
Ramalina erosa Krog	sax	M	yes	MN586995, MN586996, MN586997	Krog (1990), Sérusiaux et al. (2010), Sparrius et al. (2017)
Ramalina fastigiata (Pers.) Ach.	cor	B, M	yes	MN586998, MN586999	Sipman & Aptroot (2019)
Ramalina huei Harm.	cor	B, M	yes	MN587000, MN587001	Sipman & Aptroot (2019)
Ramalina jamesii Krog	sax	B, M	yes	MN587002, MN587003	Krog (1990), Sparrius et al. (2017)
Ramalina lacera (With.) J. R. Laundon	cor	B, M	yes	–	Follmann (1990) as *R. duriaei*
Ramalina maderensis Motyka	sax	B, M	yes	MN587004, MN587005, MN587006	Follmann (1990), Sérusiaux et al. (2010)
Ramalina cf. *maderensis* (divaricatic acid)	sax	B	yes	MN586988, MN586984, MN586985, MN586986, MN586987	Sipman & Aptroot (2019)
Ramalina mollis Krog	cor	B, M	yes	–	Sipman & Aptroot (2019)
Ramalina nematodes (Nyl.) Krog & Østh.	sax, cor	B, BR, M	yes	MN587007, MN587008	Krog & Østhagen (1980), Follmann (1990), Sparrius et al. (2017)
Ramalina portosantana Krog	sax	M	–	–	Krog (1990), Sérusiaux et al. (2010), Sparrius et al. (2017)
Ramalina pusilla Le Prévost	cor	B, M	–	–	Sipman & Aptroot (2019)
Ramalina requienii (De Not.) Jatta	sax, cor	B, M	yes	MN587009, MN587010, MN587011, MN587012, MN587013, MN587014, MN587015, MN587016	Carvalho et al. (2008) as *R. polymorpha*, Sparrius et al. (2017)
Ramalina subpusilla (Nyl.) Zahlbr.	cor	B, M	yes	MN587017, MN587018, MN587019	Sipman & Aptroot (2019)
Ramalina timdaliana Krog	sax	M	–	–	Krog (1990), Sparrius et al. (2017)
Ramalina tingitana Salzm.	sax, cor	B, M	yes	MN587025, MN587020, MN587021, MN587022, MN587023, MN587024	Follmann (1990) also as *R. bourgeana*; Krog & Østhagen (1980), Sparrius et al. (2017)

Table 1. Continued.

Taxon	Habitat	Voucher	TLC	ITS sequences	Publications
Rhizocarpon lusitanicum (Nyl.) Arnold	sax	B, M	–	–	Sipman & Aptroot (2019)
Rhymbocarpus boomii Etayo & Diederich	lichenicolous	B	–	–	Sipman & Aptroot (2019) on *Roccella phycopsis*
Rinodina anomala (Zahlbr.) H. Mayrhofer & Giralt	cor	B, BR, M	–	MN587026, MN587027	Sipman & Aptroot (2019)
Rinodina cf. anomala	cor	B	–	MN587028	Sipman & Aptroot (2019)
Rinodina beccariana Bagl.	sax	M	–	–	Sipman & Aptroot (2019)
Rinodina beccariana var. *lavicola* (J. Steiner) Matzer & H. Mayrhofer	sax	B, M	–	–	Sipman & Aptroot (2019)
Rinodina cana (Arnold) Arnold	sax	B	–	MN587029	Sipman & Aptroot (2019)
Rinodina canariensis Matzer, H. Mayrhofer & P. Clerc	sax	BR, M	–	–	Sipman & Aptroot (2019)
Rinodina exigua (Ach.) Gray	cor	M	–	–	Sipman & Aptroot (2019)
Rinodina immersa (Körb.) J. Steiner	sax	M	–	–	Sipman & Aptroot (2019)
Rinodina intermedia Bagl.	ter	B	–	–	Sipman & Aptroot (2019)
Rinodina oleae Bagl.	sax	M	–	–	Sipman & Aptroot (2019)
Rinodina oxydata (A. Massal.) A. Massal.	sax	B	–	–	Sipman & Aptroot (2019)
Rinodina pruinella Bagl.	cor	B	yes	–	Sipman & Aptroot (2019)
Roccella allorgei Abbayes	sax	M	–	–	Sparrius et al. (2017)
Roccella elisabethae Tehler	sax		–	–	Tehler et al. (2004)
Roccella fuciformis (L.) DC.	sax	B, BR, M	–	–	Sipman & Aptroot (2019)
Roccella maderensis (J. Steiner) Follmann	sax	B, BR, M	–	–	Sparrius et al. (2017)
Roccella phycopsis Ach.	sax	B, BR, M	–	–	Follmann (1990) also as *R. hypomecha*
Roccella tinctoria DC.	sax	B, M	–	–	Follmann (1990) as *R. tuberculata*, Carvalho et al. (2008) as *R. vicentina*, Sparrius et al. (2017)
Roccellographa circumscripta (Leight.) Ertz & Tehler	sax	M	–	–	Sipman & Aptroot (2019)
Rufoplaca arenaria (Pers.) Arup, Søchting & Frödén	sax, ter	B, BR	–	MN587030	Sparrius et al. (2017) cf.
Rusavskia resendei (Poelt & Tav.) S. Y. Kondr. & Kärnefelt	sax	B, BR, M	–	–	Carvalho et al. (2008), also as *X. elegans*
Schismatomma albocinctum (Nyl.) Zahlbr.	cor	B	–	–	Sipman & Aptroot (2019)
Schismatomma graphidioides (Leight.) Zahlbr.	cor	B, M	–	–	Sipman & Aptroot (2019)
Scoliciosporum umbrinum (Ach.) Arnold	sax	B, M	–	–	Sipman & Aptroot (2019)
Scytinium aragonii (Otálora) Otálora, P. M. Jørg. & Wedin	ter	M	–	–	Sipman & Aptroot (2019)
Solenopsora vulturiensis A. Massal.	sax, ter	M	–	–	Sipman & Aptroot (2019)
Sphinctrina tubiformis A. Massal.	lichenicolous	B	–	–	Sipman & Aptroot (2019) on *Pertusaria heterochroa*
Sphinctrina turbinata (Pers.) De Not.	cor	BR	–	–	Sipman & Aptroot (2019)
Squamarina cartilaginea (With.) P. James	sax, ter	B, M	–	–	Sipman & Aptroot (2019)
Syncesia myrticola (Fée) Tehler	sax, cor	B, BR, M	–	MN587031, MN587032	Sipman & Aptroot (2019)
Tephromela atra var. *deplanata* (J. Steiner) Hafellner & Hierze	sax	B, M	yes	MN587033, MN587034	Sipman & Aptroot (2019)
Thalloidima albilabrum (Dufour) Flagey	–	–	–	–	Timdal (1992) as *Toninia*
Thalloidima massatum (Tuck.) Kistenich, Timdal, Bendiksby & S.Ekman	–	–	–	–	Timdal (1992) as *Toninia*
Thalloidima toepfferi Stein	ter	photo M. Vervoort	–	–	Sipman & Aptroot (2019)
Thelenella muscorum (Th. Fr.) Vain.	ter	M	–	–	Sipman & Aptroot (2019)
Thelomma mammosum (Hepp) A. Massal.	sax	B, M	yes	–	Sipman & Aptroot (2019)
Thelopsis isiaca Stizenb.	sax	M	–	–	Sipman & Aptroot (2019)
Thelotrema laurisilvae Lücking & Breuss	cor	B, BR, M	–	–	Sipman & Aptroot (2019)
Toninia plumbina (Anzi) Hafellner & Timdal	sax	M	–	–	Sipman & Aptroot (2019)
Toniniopsis aromatica (Sm.) Kistenich, Timdal, Bendiksby & S. Ekman	sax, ter	B, BR, M	–	–	Timdal (1992) as *Toninia*
Toniniopsis mesoidea (Nyl.) Timdal	sax, ter	B, BR, M	–	–	Sipman & Aptroot (2019)
Trapelia coarctata (Turner) M. Choisy	ter	M	–	–	Sipman & Aptroot (2019)

Table 1. Continued.

Taxon	Habitat	Voucher	TLC	ITS sequences	Publications
Trapeliopsis granulosa (Hoffm.) Lumbsch	cor	M	–	–	Sipman & Aptroot (2019)
Trapeliopsis wallrothii (Flörke ex Spreng.) Hertel & Gotth. Schneid.	ter	B, M	–	–	Sipman & Aptroot (2019)
Usnea rubicunda Stirt.	cor	B	yes	–	Sipman & Aptroot (2019)
Usnea subscabrosa Nyl. ex Motyka	cor	B, M	yes	–	Sipman & Aptroot (2019)
Varicellaria velata (Turner) I. Schmitt & Lumbsch	sax, cor	B	yes	–	Sipman & Aptroot (2019)
Variospora flavescens (Huds.) Arup, Frödén & Søchting	sax	B, BR, M	–	MN587035	Sipman & Aptroot (2019)
Verrucaria macrostoma Dufour ex DC.	sax	M	–	–	Sipman & Aptroot (2019)
Verrucaria muralis Ach.	sax	M	–	–	Sipman & Aptroot (2019)
Verrucaria murina Leight.	sax	M	–	–	Sipman & Aptroot (2019)
Verrucaria nigrescens Pers.	sax	B, M	–	–	Sipman & Aptroot (2019)
Xanthoparmelia pulloides (Essl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch	sax	B, M	yes	–	Sipman & Aptroot (2019)
Xanthoparmelia tinctina (Maheu & A. Gillet) Hale	sax	M	–	–	Carvalho et al. (2008) as *X. conspersa*
Xanthoparmelia verruculifera (Nyl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch	sax	B, M	yes	–	Sipman & Aptroot (2019)

recognition of the shade forms relies on the black pycnidium ostioles and thick septa. The tropical species *C. leptozona* may be closer to *I. serusiauxii* because it shares the black pycnidia, but that species is saxicolous, its discs turn black, and its spores have shorter septa about half as thick as spore length. Unfortunately, no ITS sequence of this species was available in Genbank.

The only other *Ikaeria* species, *I. aurantiellina*, shares the black pycnidia and thick spore septa (spores 12–14 × 7–8 µm, septa ~6–8 µm thick, ratio of septum width/spore length 0.5–0.67), and can be distinguished easily by the 'biatorine' apothecia (Giralt et al. 1992). However, a closer look shows that the apothecia of the two species are anatomically indistinguishable except for the somewhat shorter ascospores in *I. aurantiellina*. Externally there is a difference in apothecium margin color. In *I. aurantiellina* the margin is deep yellow to orange, slightly paler at the disc, reflecting the constant presence of anthraquinones. This gives it a biatorine appearance, but anatomically the margin contains numerous algae. In *I. serusiauxii* the margin is greenish grey, with more or less black pigment, and it lacks anthraquinones. This gives the apothecia a lecanorine appearance, especially when the black pigment is scarce.

The synonymy of *I. aurantiellina* (as *Caloplaca aurantiellina*) with *C. aegatica* was first suggested by Boom & Etayo (2006), who admitted that the original description of *C. aurantiellina* is fairly different. Apparently they did not study any type material, so the synonymy may need revision.

Kondratyuk et al. (2017) mentioned two genera closely related to *Ikaeria* or having a similar basal root: *Yoshimuria* and *Fominiella*. The first genus is included in Figure 1, where it shows up in the *Caloplacoideae*. Thus it seems unrelated to our new *Ikaeria* species. The second contains two species: *F. skii* and *F. tenerifensis*. The ITS sequence of *F. skii* shows an affinity with the genus *Athallia*, as Kondratyuk et al. (2017) admit. In our Figure 1 the species is positioned accordingly and shows no close relation with *Ikaeria*. For the second species, *F. tenerifensis*, no ITS sequence is available. The description and illustration of *F. tenerifensis* suggest that it differs from *I. serusiauxii* by the absence of black pigment in the prothallus, apothecium margins and pycnidium ostioles, and by the shorter ascospore septa, about half of spore length. The illustration presented in Kondratyuk et al. (2018, p. 179, Fig. 20) also suggests a different species.

Specimens examined (*Ikaeria serusiauxii*). PORTUGAL. Madeira Islands, Porto Santo: E part, SW side of Pico Juliana, saddle with Pico do Facho; 350 m; 33°5.3′N, 16°19.4′W; *Pinus* and *Cupressus* plantations on abandoned fields with stone walls (113). On twigs, with *Cliostomum griffithii*, *Rinodina pruinella*, *Ikaeria aurantiellina*; 2 March 2016; H. Sipman 62957 (B 60 0200914). id., E part, Pico do Castelo, summit area; ~400 m; 33°4.8′N, 16°20.0′W; on *Cupressus* on S side towards parking place; 28 Feb. 2016; H. Sipman 62798 (MADJ). ITS: MN586958; LSU: MN586913; SSU: MN586907; id., E part, Pico do Castelo, summit area; ~400 m; 33°4.8′N, 16°20.0′W; epiphytic on S-slope; 28 Feb. 2016; H. Sipman 62802 (B 60 0200759). ITS: MN586959; LSU: MN586914; SSU: MN586908; id., E part, SW side of Pico Juliana, saddle with Pico do Facho; 350 m; 33°5.3′N, 16°19.4′W; *Pinus* and *Cupressus* plantations on abandoned fields with stone walls (113), on twigs, with *Cliostomum griffithii*, *Rinodina pruinella*; 2 March 2016; mixed in H. Sipman 62957 (B 60 0200914). LSU: MN586915; SSU: MN586909. Madeira: along road near Portela; 575 m; 32°44.8′N, 16°49.6′W; on *Cedrus* tree; 15 Apr. 2001; F. Schumm 13606 (B 60 0171731). id., Südöstlich von Camacha, Richtung Assomada; 500 m; epiphytisch an *Malus* sp., trocken-warmer Standort; 5 Oct. 1993, Kirschbaum 3075 (herb. Kirschbaum). Algarve: W of Lagos, road Vale de Boi to Barão de San Miquel, 25 m; 37°05.9′N, 8°48.0′W; on *Ficus* in orchard with *Ficus* and *Prunus dulcis*; 21 July 1993, P. van den Boom 14565 (herb. van den Boom). id., 14 km WSW of Lagos, along road to Salema, 50 m; 37°04.4′N, 08°49.5′W; On *Ceratonia* on SE slope with *Ficus*, *Prunus dulcis* and *Ceratonia*; 23 July 1993, P. van den Boom 14674 (herb. van den Boom), Estremadura: 25 km W of Setubal, area of Aldeia do Meco, 50 m; on *Ficus carica* in meadow near camping; 12 Aug. 1987, P. van den Boom

6607 (herb. van den Boom). SPAIN. Canary Islands, Fuerteventura: 7.5 km SSW of Pájara, SW of Fayagua, Degollada del Viento, near viewpoint, 420 m; 28°17.4′N, 14°09.2′W; on *Launaea* on N slope with volcanic outcrops and shrubs; 3 March 2001, P. & B. van den Boom 26124 (herb. van den Boom). El Hierro: W of Sabinosa, along HI-500 road, W of Montaña del Escobar, 260 m; 27°45.20′N, 018°08.50′W; on *Juniperus* on W slope, on field with volcanic outcrops, shrubs and some dead old *Juniperus turbinata* ssp. *canariensis* trees; 27 March 2009, P. & B. van den Boom 42177 (herb. van den Boom).

Specimens examined (*Ikaeria aurantiellina*). PORTUGAL. Madeira Islands, Porto Santo: E part, SW side of Pico Juliana, saddle with Pico do Facho; 350 m; 33°5.3′N, 16°19.4′W; *Pinus* and *Cupressus* plantations on abandoned fields with stone walls (113), on twigs, with *Cliostomum griffithii*, *Rinodina pruinella*, *Ikaeria serusiauxii*; 2 March 2016; mixed in H. Sipman 62957 (B 60 0200914). ITS: MN586956; LSU: MN586911; SSU: MN586905. id., E part, lower slopes N of Pico do Facho; ~350 m; 33°05.2′N, 16°19.3′W: epiphytes on fallen *Pinus* trees on slope; 2 March 2016; H. Sipman 62969a (B 60 0200983). ITS: MN586957; LSU: MN586912; SSU: MN586906.

Acknowledgements

The participants in the fieldwork on Porto Santo, Laurens B. Sparrius, Israel Pérez-Vargas, Paula Matos, Alice Gerlach and Maaike Vervoort, are gratefully acknowledged for pleasant and effective cooperation. Sergio Perez-Ortega (Madrid, Spain) kindly arranged the permits. Access to the study area and permission to collect lichen specimens was granted by Parque Natural da Madeira (permit no. 1/PNM/2016). Pieter van den Boom (Son, The Netherlands) kindly provided additional specimens from his valuable herbarium and gave useful suggestions about identification. Arsen Gasparyan (Yerevan, Armenia) kindly helped with the DNA studies. Jan Vondrak (Průhonice, Czech Republic) gave valuable suggestions for improvement of the manuscript.

References

Arup, U., Søchting, U. & Frödén, P. 2013. A new taxonomy of the family *Teloschistaceae*. *Nordic Journal of Botany* 31: 016–083.

Carvalho, P., Figueira, R. & Jones, M. P. 2008. Os líquenes e fungos liquenícolas (Fungi) dos arquipélagos da Madeira e Selvagens In: Borges, P. A. V., Abreu, C., Aguiar, A. M. F., Carvalho, P., Fontinha, S., Jardim, R., Melo, I., Oliveira, P., Sequeira, M. M., Sérgio, C., Serrano, A. R. M., Sim-Sim, M. & Vieira, P., Listagem dos fungos, flora e fauna terrestres dos arquipélagos da Madeira e Selvagens. p. 95–103, [105]–122. Funchal, Angra do Heroísmo: Direcção Regional do Ambiente da Madeira and Universidade dos Açores.

Fletcher, A. & Laundon, J. R. 2009. *Caloplaca*. In: Smith, C. W., Aptroot, A., Coppins, B. J., Fletcher, A., Gilbert, O. L., James, P. W. & Wolseley, P. A. (eds), *The lichens of Great Britain and Ireland*, pp. 245–273. The British Lichen Society, Department of Botany, The Natural History Museum, London.

Follmann, G. 1990. Zur Kenntnis der Flechtenflora und Flechtenvegetation von Madeira und den umliegenden Inseln. I. Chorologisch-soziologischer Abriss. Courier Forschungsinstitut Senckenberg 129: 91–102.

Giralt, M., Nimis, P. L. & Poelt, J. 1992. Studien über den Formenkreis von *Caloplaca flavorubescens* in Europa. *Cryptogamie*, *Bryologie-Lichénologie* 13: 261–273.

Haugan, R. 1992. *Anzia centrifuga*, a new lichen species from Porto Santo, Madeira. *Mycotaxon* 44: 45–50.

Hoang, D. T., Chernomor, O., Haeseler, A. von, Minh, B. Q. & Vinh, L. S. 2018. UFBoot2: Improving the ultrafast bootstrap approximation. *Molecular Biology and Evolution* 35: 518–522.

Kondratyuk, S. Y., Lökös, L., Upreti, D. K., Nayaka, S., Mishra, G. K., Ravera, S., Jeong, M.-H., Jang, S.-H., Park, J. S. & Hur, J.-S. 2017. New monophyletic branches of the *Teloschistaceae* (lichen-forming ascomycota) proved by three gene phylogeny. *Acta Botanica Hungarica* 59: 71–136.

Kondratyuk, S. Y., Lökös, L., Halda, J. P., Farkas, E., Upreti, D. K., Thell, A., Woo, J.-J., Oh, S.-O. & Hur, J.-S. 2018. New and noteworthy lichen-forming and lichenicolous *Fungi* 7. *Acta Botanica Hungarica* 60: 115–184.

Krog, H. 1990. New Ramalina species from Porto Santo, Madeira. *The Lichenologist* 22: 241–247.

Krog, H. & Østhagen, H. 1980. Two new *Ramalina* species from Porto Santo, the Madeira Islands. *Norwegian Journal of Botany* 27: 185–188.

Kukwa, M., Schmitt, I. & Ertz, D. 2018. *Ochrolechia incarnata* comb. nov. (*Lecanoromycetes*, *Ascomycota*), a distinct species of the *O. parella* group from Europe and Macaronesia. – Phytotaxa 371(2): 119–126.

Meyer, B. 2002. Die Flechtengattung Clauzadea. Sendtnera 8: 85–154.

Nguyen, L.-T., Schmidt, H. A., Haeseler, A von, & B. Q. Minh, B. Q. 2015. IQ-TREE: A fast and effective stochastic algorithm for estimating maximum likelihood phylogenies. *Molecular Biology and Evolution* 32: 268–274.

Pitard, J. & Harmand, J. 1911. Contribution à l'étude des lichens des îles Canaries. *Bulletin de la Societé Botanique de France* 58, Mém. 22: 1–72.

Sérusiaux, E., van den Boom, P. & Ertz, D. 2010. A two-gene phylogeny shows the lichen genus *Niebla* (*Lecanorales*) is endemic to the New World and does not occur in Macaronesia nor in the Mediterranean basin. *Fungal Biology* 114: 528–537.

Sipman, H. & Aptroot, A. 2019. Pictures of PORTO SANTO lichens and lichenicolous fungi. https://archive.bgbm.org/sipman/Zschackia/PortoSanto/genuslist.htm [14 Aug. 2019]

Šoun, J., Vondrak, J., Søchting, U., Hrouzek, P., Khodosovtsev, A. & Arup, U. 2011. Taxonomy and phylogeny of the *Caloplaca cerina* group in Europe. *The Lichenologist* 43: 113–135.

Sparrius, L. B., Aptroot, A., Sipman, H. J. M., Pérez-Vargas, I., Matos, P., Gerlach, A. & Vervoort, M. 2017. Estimating the population size of the endemic lichens *Anzia centrifuga* (*Parmeliaceae*) and *Ramalina* species (*Ramalinaceae*) on Porto Santo (Madeira Archipelago). *The Bryologist* 120: 293–301.

Tehler, A., Dahlkild, A., Eldenas, P. & Feige, G. B. 2004. The phylogeny and taxonomy of Macaronesian, European and Mediterranean *Roccella* (*Roccellaceae*, *Arthoniales*). *Symbolae Botanicae Upsalienses* 34: 405–428.

Tehler, A., Ertz, D. & Irestedt, M. 2013. The genus *Dirina* (*Roccellaceae*, *Arthoniales*) revisited. – The Lichenologist 45(4): 427–476.

Timdal, E. 1992. A monograph of the genus *Toninia* (*Lecideaceae*, *Ascomycetes*). *Opera Botanica* 110: 1–137.

Trifinopoulos, J., Nguyen, L.-T., Haeseler, A. von & Minh, B. Q. 2016. W-IQ-TREE: a fast online phylogenetic tool for maximum likelihood analysis. *Nucleic Acids Research* 44 (W1): W232–W235.

Van den Boom, P. P. G. & Etayo, J. 2006. New records of lichens and lichenicolous fungi from Fuerteventura (Canary Islands), with descriptions of some new species. *Cryptogamie*, *Mycology* 27: 341–374.

Zakeri, Z., Divakar, P. K. & Otte, V. 2017. Taxonomy and phylogeny of *Aspiciliella*, a resurrected genus of *Megasporaceae*, including the new species *A. portosantana*. *Herzogia* 30: 166–176.