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

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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 Xanthoroiideae 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 Letrouititia as outgroups, with Caloplaca cerina and C. haematites...
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 *Cineoreufa-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,
~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 (Sou 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 |
|-------|---------|---------|-----|---------------|--------------|
| Acroruspora laticola J. Steiner | sax | B, M | – | MN586918 | Sipman & Aptroot (2019) |
| Acroruspora veronensis A. Massal. | sax | B, M | – | MN586919 | Sipman & Aptroot (2019) |
| Acrocradia salwewyi (Leight. ex Nyl.) A. L. Sm. | sax | M | – | Sipman & Aptroot (2019) |
| Agonimia tristicha (Ny1.) Zahlbr. | cor | M | – | Sipman & Aptroot (2019) |
| Alyxia ochrocheila (Ny1.) Ertz & Tehler | sax | M | – | Sipman & Aptroot (2019) |
| Alyxia varia (Pers.) Ertz & Tehler | cor | B, M | – | Sipman & Aptroot (2019) |
| Amandinea pelidina (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 punctecaria (Turner ex Sm.) Ertz & Diederich | sax | M | – | Sipman & Aptroot (2019) |
| Aspicillicula portosantana Sipman & Zakeri | sax | B, BR, M | yes | MN586922, MN586923, MN586924 | Sipman & Aptroot (2019) |
| Bacidia laurocerasi (Delise ex Duby) Zahlbr. | cor | M | – | Sipman & Aptroot (2019) |
| Bacidina arnoldiana (Körb.) Ertz & Tehler | sax | M | – | Sipman & Aptroot (2019) |
| Bacidia flavovirescens (Wulfen) Dalla Torre & Sarnth. | cor | B | – | Sipman & Aptroot (2019) |
| Bacidia neotaurica Vondrak, Khodos., Arup & Sachting | sax | M | – | Sipman & Aptroot (2019) |
| Candelariella vitellina (Taylor) Mudd | sax | B, M | – | Sipman & Aptroot (2019) |
| Candelaria mediterranea Giralt | cor | B | – | Sipman & Aptroot (2019) |
| Candelaria sp. | sax | B | – | MN58696, MN58693, MN586947, MN586948 | Sipman & Aptroot (2019) |
| Candelariella vitellina (Hoffm.) Müll. Arg. | sax | B, BR, M | – | Follmann (1990) as B. lactea |
| 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 | – | – | Sipman & Aptroot (2019) on Ramalina crispatula, lower part of lobes |
| Catillaria minuta (Schae.) Lettau | sax | M | – | Sipman & Aptroot (2019) |
| Chaeothece 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, Savič & Tibell | sax | B, M | – | Sipman & Aptroot (2019) |
| Cladonia halmis (With.) J. R. Laundon | ter | B, M | – | Sipman & Aptroot (2019) |
| Cladonia macilenta Hoffm. | ter | M | – | Sipman & Aptroot (2019) |
| Cladonia microphylla Alti & 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 rangformis Hoffm. | ter | B, M | yes | Sipman & Aptroot (2019) |
| Cladonia streptocladia Abbayes | ter | B, M | – | MN586950 | Sipman & Aptroot (2019) |
| Clausenda metziari (Körb.) | sax | M | – | Meyer (2002), Clausenda & Clausenda ex D. Hawkes. |
| Clavascidium lacinulatum (Ach.) M. Prieto | ter | BR, M | – | Sipman & Aptroot (2019) |
| Clostomum griffithii (Sm.) Coppins | sax, cor | B, BR, M | – | Sipman & Aptroot (2019) |
| Coccocarpia erythroxyl (Spreng.) Swinscow & Krog | sax | M | – | Sipman & Aptroot (2019) |
| Coenogonium luteum (Dicks.) Kalb & Lücking | cor | M | – | Sipman & Aptroot (2019) |
| Taxon                                  | Habitat | Voucher | TLC   | ITS sequences                  | Publications                          |
|---------------------------------------|---------|---------|-------|---------------------------------|---------------------------------------|
| **Collema ryssoleum** (Tuck.) Schneid. | sax     | B, M    | –     | –                               | Sipman & Aptroot (2019)               |
| **Collemopsidium caesium** (Nyl.) Copps & Aptroot | sax     | M       | –     | –                               | Sipman & Aptroot (2019)               |
| **Cresponia prennesia** (Ach.) Egea & Torrente | cor     | B, M    | –     | –                               | Sipman & Aptroot (2019)               |
| **Crodia aurata** (Ach.) Link         | cor     | B, M    | –     | –                               | Sipman & Aptroot (2019)               |
| **Dimelaena radiata** (Tuck.) Hale & W. L. Curb. | cor     | B       | yes   | –                               | Sipman & Aptroot (2019)               |
| **Diplodia canescens** (Dick.) A. Massal. | sax     | B, BR, M| –     | –                               | Sipman & Aptroot (2019)               |
| **Diplodia subcanescens** (Werner) Hafellner & Poelt | sax     | B, BR, M| –     | –                               | Follmann (1990)                      |
| **Diploschistes actinostomus** (Ach.) Zahlbr. | sax     | B, M    | –     | –                               | MN586951, MN586952, MN586953           |
| **Dirina cf. ceratoniae** (Ach.) Fr.  | cor     | –       | –     | –                               | Sipman & Aptroot (2019)               |
| **Dirina insulana** (Tav.) Tehler    | cor     | –       | –     | –                               | Sipman & Aptroot (2019)               |
| **Dirina paradoxa subsp. africana** (Tehler) | cor     | –       | –     | –                               | Sipman & Aptroot (2019)               |
| **Dirinaria aphrodisia** (Fée) D. D. Awasthi | sax     | B       | –     | –                               | MN586954                              |
| **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    | –     | –                               | MN586955                              |
| **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 |
| **Fulgensia desertorum** (Tomin) Poelt | ter     | –       | –     | –                               | Sipman & Aptroot (2019)               |
| **Fulvophyton sorediatum** (Sparrius, P. James & M. A. Allen) Tehler & van den Boom | sax     | B       | –     | MN586954                        | Sipman & Aptroot (2019)               |
| **Gyalecta schisticola** Werner       | sax, ter| B, M    | –     | –                               | Sipman & Aptroot (2019)               |
| **Heppia conchiloba** Werner         | ter     | M       | –     | –                               | Sipman & Aptroot (2019)               |
| **Heteroderma leucomelos** (L.) Poelt | sax, ter| BR, M   | yes   | –                               | Carvalho et al. (2008)                |
| **Hyperphyscia adglutinata** (Flörke) | 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 Giral, Nims & Poelt) | cor     | B       | –     | MN586957, MN586956              | Sipman & Aptroot (2019)               |
| **Lecania cuprea** (A. Massal.) Van den Boom & Coppins | sax     | 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| –     | –                               | Sipman & Aptroot (2019)               |
| **Lecanora campesiris** (Schauer.) Hue | sax     | M       | yes   | MN586965                        | Sipman & Aptroot (2019)               |
| **Lecanora confusa** Alm.             | cor     | B, M    | –     | –                               | Follmann (1990)                      |
| **Lecanora gongaleoides** 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. praepectorata** 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)               |
| 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 sarcognoides Körb. | sax | B, BR, M | – | – | Sipman & Aptroot (2019) |
| Lecidella cf. elaeochromoides (Nyl.) Knoph & Hertel | sax | B | – | MN586975, MN586976 | Sipman & Aptroot (2019) |
| Lecidella cf. meiococcus (Nyl.) Leuckert & Hertel | sax | B | – | MN586979 | Sipman & Aptroot (2019) |
| Lecidella scabra (Taylor) Hertel & Leuckert | sax | B, BR, M | yes | – | Sipman & Aptroot (2019) |
| Lecidella cf. meiococcus (Nyl.) Leuckert & Hertel | sax | B | – | MN586975, MN586976 | Sipman & Aptroot (2019) |
| Lecidella cf. meiococcus (Nyl.) Leuckert & Hertel | sax | B | – | MN586979 | Sipman & Aptroot (2019) |
| Lecidella sp. | sax | B | – | MN586975, MN586976 | Sipman & Aptroot (2019) |
| Lecidella sp. | sax | B | – | MN586979 | Sipman & Aptroot (2019) |
| Lepraria maderensis Kukwa & Flakus | sax | B | yes | – | Sipman & Aptroot (2019) |
| Lepraria maderensis Kukwa & Flakus | sax | B | yes | – | Sipman & Aptroot (2019) |
| Leptogium teretiusculum (Flörke ex Wallr.) Arnold | sax | B, BR, 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 | B | – | MN586980 | Sipman & Aptroot (2019) |
| Mycogonium sparsellum Nyl. | cor | B, M | yes | – | Sipman & Aptroot (2019) |
| Myriolecis crenulata (Ach.) Śliwa, Zhao Xin & Lumbsch | cor | B, M | yes | – | Sipman & Aptroot (2019) |
| Myriolecis dispersa (Pers.) Śliwa, Zhao Xin & Lumbsch | cor | B, M | yes | – | Sipman & Aptroot (2019) |
| Myriolecis hagenii (Ach.) Śliwa, Zhao Xin & Lumbsch | cor | B, M | yes | – | Sipman & Aptroot (2019) |
| Nephroma foliolatum P. James & F. J. White | sax, ter | B | yes | – | Sipman & Aptroot (2019) |
| Nephroma laevigatum Ach. | ter | B | yes | – | Sipman & Aptroot (2019) |
| Normandina pulchella (Borrer) Nyl. | sax, cor | B, M | – | – | Sipman & Aptroot (2019) |
| Ochrolechia incarnata (Leight.) Kukwa, Schmitt & Ertz | sax on | B | – | MN586981 | Kukwa et al. (2018) |
| Opegrapha demutata Nyl. | cor | M | – | – | Sipman & Aptroot (2019) |
| Opegrapha tumulenta Nyl. | cor | M | – | – | Sipman & Aptroot (2019) |
| Opegrapha vulgata (Ach.) Ach. | cor | B, BR, M | – | – | Sipman & Aptroot (2019) |
| Orcaria insperata (Nyl.) Kalb & Giralt | cor | B, BR, M | – | – | Sipman & Aptroot (2019) |
| Parmotrema perlatum (Huds.) M. Choisy | cor | B, M | – | – | Sipman & Aptroot (2019) |
| Parmotrema reticulatum (Taylor) M. Choisy | cor | B, BR, M | – | – | Sipman & Aptroot (2019) |
| Parmotrema tinctorum (Despr. ex Nyl.) Hale | cor | B, BR, M | – | – | Sipman & Aptroot (2019) |
| Pectenia atlantica (Degel.) P. M. Jørg., L. Lindblom, Wedin & S. Ekman | cor | B, BR, M | – | – | Sipman & Aptroot (2019) |
| Peltula bolanderi (Tuck.) Wettmore | cor | B, M | – | – | Sipman & Aptroot (2019) |
| Peltula euploca (Ach.) Poelt | cor | B, BR, M | – | – | Sipman & Aptroot (2019) |
| Peltula obscurans (Nyl.) Geyln. | cor | B, M | – | – | Sipman & Aptroot (2019) |
| Peltula omphaliza (Nyl.) Wettmore | cor | B, M | – | – | Sipman & Aptroot (2019) |
| Pertusaria aleianta Nyl. | cor | B, M | – | – | Follmann (1990) as Pertusaria heterochroa (Müll. Arg.) Ertz |
| 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 boccaanum (Sér. Vit.) 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 | sax | B, M | – | MN586983, MN586982 | Sipman & Aptroot (2019) |
| Protoparmeliopsis muralis (Schreb.) M. Choisy | sax | B | – | – | Sipman & Aptroot (2019) |
| Psora decipiens (Hedw.) Hoffm. | cor | B | yes | – | Follmann (1990) as R. subwebbiana, Sparrius et al. (2017) |
| Psorotichia murorum A. Massal. | sax | M | yes | – | Sipman & Aptroot (2019) |
| Pyrenula chlorospila (Nyl.) Arnold | sax | BR | – | – | Sipman & Aptroot (2019) |
| Pyrrhospora quernea (Dicks.) Körb. | cor | B, M | yes | – | 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 crispatula Despr. ex Nyl. | sax | B, M | yes | MN586989 | Sipman & Aptroot (2019) |
| Ramalina decipiens Mont. | sax | B, M | yes | MN586991, MN586990, MN586992, MN586994 | Sipman & Aptroot (2019) |
| Ramalina eosa Krog | sax | M | yes | MN586995, MN586996, MN586997 | Sipman & Aptroot (2019) |
| 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 | Sipman & Aptroot (2019) |
| Ramalina lacera (With.) J. R. Laundon | cor | B, M | yes | – | Follmann (1990) as R. duriaci, Sipman & Aptroot (2019) |
| Ramalina maderensis Motyka | sax | B, M | yes | MN587004, MN587005, MN587006 | Sipman & Aptroot (2019) |
| 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 portusantana Krog | sax | M | – | – | Krog (1990), Sipman & Aptroot (2019) |
| 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) |
| Taxon                              | Habitat | Voucher | TLC | ITS sequences | Publications                  |
|-----------------------------------|---------|---------|-----|---------------|--------------------------------|
| Rhizocarpon lusitanicum (Nyl.) Arnold | sax, M  | –       | –   | –             | Sipman & Aptroot (2019)        |
| Rhizomarina saxifraga (Kürschner)  | sax, M  | –       | –   | –             | Sipman & Aptroot (2019)        |
| Rinodina anomala (Zahlbr.) H. Mayrhofer & Giralt | cor, 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, BR, M | – | – | – | 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) |
| Roccella allorgei Abbeyes | cor, B | yes | – | – | Sipman & Aptroot (2019) |
| Roccella elisabethae Tehler | sax, ter | – | – | – | Sipman & Aptroot (2019) |
| Roccella fuciformis (L.) DC. | sax, B, BR, M | – | – | – | Sipman & Aptroot (2019) |
| Roccella phycopsis (J. Steiner) Follmann | sax, B, BR, M | – | – | – | Sipman & Aptroot (2019) |
| Roccella tinctoria DC. | sax, B, M | – | – | – | Sipman & Aptroot (2019) |
| Roccellago circumscripta (Leight.) Ertz & Tehler | sax, M | – | – | – | Sipman & Aptroot (2019) |
| Rufoplaca arenaria (Pers.) Arup, Sochting & Frödén | sax, ter, B, BR | – | MN587030 | – | Sparrius et al. (2017) |
| Rusavskia resedaei (Poelt & Tav.) S. Y. Kondr. & Kärnefelt | sax, B, BR, M | – | – | – | Sipman & Aptroot (2019) |
| Schismatomma albovittatum (Nyl.) Zahlbr. | cor, B | – | – | – | Sipman & Aptroot (2019) |
| Schismatomma graphidosides (Leight.) Zahlbr. | cor, B, M | – | – | – | Sipman & Aptroot (2019) |
| Scoliciosporum umbrinum (Ach.) Gray | sax, B, M | – | – | – | Sipman & Aptroot (2019) |
| Scytinium aragonii (Otálora) Otálora, P. M. Jørg. & Wedin | ter, M | – | – | – | Sipman & Aptroot (2019) |
| Solenoporina vinturienis A. Massal. | sax, ter, B, BR, M | – | – | – | Sipman & Aptroot (2019) |
| Sphinctrina tubiformis A. Massal. | sax, ter, B, BR, M | – | – | – | Sipman & Aptroot (2019) |
| Sphinctrina turbinata (Pers.) De Not. | cor, BR | – | – | – | Sipman & Aptroot (2019) |
| Squamarina cartilaginea (With.) P. James | sax, ter, B, BR, M | – | – | – | Sipman & Aptroot (2019) |
| Synecia myrticola (Fée) Lehner | sax, cor, B, BR, M | – | MN587031, MN587032 | – | Sipman & Aptroot (2019) |
| Tephronema ulterior var. planeata (J. Steiner) Hafellner & Hierze | sax, B, M | yes | MN587033, MN587034 | Sipman & Aptroot (2019) |
| Thelotremata alabralbum (Dufour) Flagey | – | – | – | – | Timdal (1992) as Toniina |
| Thelotremata massatum (Tuck.) Kistennich, Timdal, Bendiksky & S.Ekman | – | – | – | – | Timdal (1992) as Toniina |
| Thelotremata toepfferi Stein | ter, photo | – | – | – | 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 isica Sitzenb. | sax, BR, M | – | – | – | Sipman & Aptroot (2019) |
| Thelotrema laricisylvae Lücking & Breuss | cor, B, BR, M | – | – | – | Sipman & Aptroot (2019) |
| Toninia plumbea (Anzi) Hafellner & Timdal | sax, ter, B, BR, M | – | – | – | Timdal (1992) as Toniina |
| Tonicia hirsuta (Hedw.) Timdal | sax, ter, B, BR, M | – | – | – | Timdal (1992) as Toniina |
| Tonicia mesosticta (Nyl.) Timdal | sax, ter, B, BR, M | – | – | – | Timdal (1992) as Toniina |
| Trapelia coarctata (Turner) M. Choisy | ter, M | – | – | – | Sipman & Aptroot (2019) |
I. aurantiellina somewhat shorter ascospores in species are anatomically indistinguishable except for the ever, a closer look shows that the apothecia of the two by the ‘biatorine’ apothecia (Giralt et al. 1992). How-
spore length 0.5–0.67), and can be distinguished easily as thick as spore length. Unfortunately, no ITS sequence turn black, and its spores have shorter septa about half the black pycnidia, but that species is saxicolous, its discs because it shares
I. serusiauxii tozona recognition of the shade forms relies on the black pycnid-ium ostioles and thick septa. The tropical species

Table 1

| Taxon                              | Habitat | Voucher | TLC | ITS sequences | Publications                  |
|------------------------------------|---------|---------|-----|---------------|-------------------------------|
| Trachelopis granulosa (Hoffm.) Lumbsch | cor     | M       | –   | –             | Sipman & Aptroot (2019)      |
| Trachelopis wallrothii (Flörke ex Spreng.) Hertel & Goth. 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 & Soechting | sax, 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    | yes | –             | 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 Xanthoparmelia versuculifera (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. Exter-
nally 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 ourFigure 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 Clidostomum 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 Clidostomum 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., Südsüdöstlich von Portela; 500 m; epiphytisch an Malus sp., trocken-warmer Standort; 5 Oct. 1993, 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 214565 (herb. van den Boom). id., 14 km WSW of Lagos, along road to Salema, 50 m; 37°04.4′N, 16°49.6′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 Méco, 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 Lecanora on 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 Juniperos 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 Clistostomum griffithii, Rinodina pruinella, Ikaeria serusiauxii; 2 March 2016; mixed in H. Sipman 62957 (B 60 0200914). ITS: MN86956; LSU: MN86911; SSU: MN86905. 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: MN86957; LSU: MN86912; SSU: MN86906.

Acknowledgements

The participants in the fieldwork on Porto Santo, Laurens B. Sparrius, Israel Pérez-Vargas, Paula Matos, Alice Gerlach and Maike 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 Vondrák (Průhonice, Czech Republic) gave valuable suggestions for improvement of the manuscript.

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