An updated checklist of the lichens of St. Eustatius, Netherlands Antilles

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Abstract
In the course of a multi-taxon biodiversity inventory for the island of St. Eustatius, lichens were collected from 11 plots representing different vegetation types. From these collections, 126 lichen species are reported, 54 of which are new reports for St. Eustatius. Most species could be identified to species level based on morphological and chemical characters. In a few cases, mtSSU DNA sequences were generated for a preliminary molecular identification and future phylogenetic studies. In total, 263 identified lichen species are currently known from St. Eustatius, as well as some additional genera with yet unidentified species and lichenicolous fungi.

Keywords
Biodiversity inventory, lichens, mtSSU, St. Eustatius

Introduction

Sint Eustatius is a small island (21 km²) in the northern Leeward Islands part of the West Indies. It is one of the six islands of the Netherlands Antilles and, since 2010, a special municipality of the Netherlands. Sint Eustatius is roughly divided into three parts, the Northern Hills, the urbanised central area (‘Cultuurvlakte’) and the southern part dominated by the steep dormant volcano The Quill (600 m elev.). Although the whole island of St. Eustatius has been heavily impacted by human activities, the northern and
southern parts are nowadays designated as National Parks with varied vegetation types especially on the slopes of The Quill. The latter comprise, for example, thorny woodlands, deciduous to evergreen seasonal forests, dry evergreen forest, montane thickets and elfin woodland (Stoffers 1956). A re-classification of the vegetation of St. Eustatius, based on cluster analysis of sample plots, resulted in 13 vegetation types characterised by different combinations of individual vascular plant species (Freitas et al. 2014).

Just as in almost all other groups of organisms, lichens are most diverse in the tropics (Sipman and Aptroot 2001). On St. Eustatius, they are commonly present on various substrates, including tree bark and twigs, siliceous rock, limestone, dead wood and living leaves. Despite their abundance, the lichen flora of St. Eustatius is still incompletely known. The authors are aware of only nine publications citing in total 14 lichen species from St. Eustatius, viz. *Phyllopsora corallina* (Eschw.) Müll. Arg. and *P. parvifoliella* (Nyl.) Müll. Arg. (Brako 1991), *Anisomeridium excellens* (Müll. Arg.) R.C. Harris (Harris 1995), *Syncesia glyphysoides* (Fée) Tehler (Tehler 1997), *Pseudopyrenula subnudata* Müll. Arg. (Harris 1998, as *P. diluta* var. *degenerans* Vain.), *Stirtonia neotropica* Aptroot, described based on material from St. Eustatius and Costa Rica (Aptroot 2009), *Syncesia subintegra* Sipman, described based on material from St. Eustatius, as well as *S. farinacea* (Fée) Tehler, *S. glyphysoides* and *S. graphica* (Fr.) Tehler (Sipman 2009), *Roccella gracilis* Bory (Aptroot and Schumm 2011), *Dirina paradoxa* (Fée) Tehler (Tehler et al. 2013), as well as *Astrothelium bicolor* (Taylor) Aptroot & Lücking, *A. phlyctaena* (Fée) Aptroot & Lücking and *Pseudopyrenula subnudata* Müll. Arg. (Aptroot and Lücking 2016).

The main source of information about the lichen flora of St. Eustatius is the online portal ‘Plants and Lichens of St. Eustatius’ (Boom et al. 2009). It contains a list with 209 lichen species, based on specimens collected by H. Sipman and W.R. Buck in 2008, identified by H. Sipman and mostly hosted in B (some in NY). In addition, some identified specimens are present in various other herbaria, some of which can be searched online. For instance, the database of BR cites the following identified specimens from St. Eustatius, collected by R. Hensen in 1991 and identified by the first author: *Megalaria bengalensis* Jagadeesh Ram & Aptroot, *Porina mastoidea* (Ach.) Müll. Arg. and *Sticta xanthotropa* (Kremp.) D.J. Galloway.

In 2015, a plot-based, multi-taxon biodiversity inventory of St. Eustatius was carried out by Naturalis Biodiversity Center, the European Invertebrate Survey (EIS) and different Dutch non-governmental organisations, together with St. Eustatius National Parks Foundation (STENAPA) and students from different Dutch universities. Here, the lichen records of that inventory are reported and an updated checklist of the lichens known from St. Eustatius is presented.

**Materials and methods**

As part of a multi-taxon inventory, lichens were collected on St. Eustatius from 11 plots (25 m × 25 m) in different main vegetation types according to Freitas et al. (2014). Two plots (H1, H2) were situated in the Northern Hills area, eight (M1–M5,
M7–M9) on and around The Quill in the southern part of the island and one (U1) in the central urban area. Details concerning the location and vegetation characteristics of the plot locations and the multi-taxon sampling approach are described in van Andel et al. (2016). Lichens were collected using a knife or hammer and chisel and subsequently air-dried and stored in paper bags.

Specimens were observed and identified by the first author using an Olympus SZX7 stereomicroscope and an Olympus BX50 compound microscope with interference contrast, connected to a Nikon Coolpix digital camera. Sections were mounted in tap water, in which all measurements were also taken. The chemistry of selected specimens was investigated by thin-layer chromatography (Orange et al. 2001), using solvent A.

DNA analysis based on mitochondrial ribosomal small subunit (mtSSU) sequences was carried out for ten unidentifiable or provisionally identified specimens of good quality (indicated in Table 1). Although the nuclear ribosomal ITS region is the generally accepted fungal DNA barcode locus (Schoch et al. 2012), mtSSU was chosen since more mtSSU than ITS sequences have yet been published for several of the genera or families to which the respective specimens putatively belong.

Genomic DNA was extracted using the NucleoMag 96 Plant kit (Macherey-Nagel) on the KingFisher Flex Purification System (ThermoFisher Scientific). The mtSSU region was PCR-amplified following Zoller et al. (1999) in terms of primers (mrSSU1/mrSSU3R) and the PCR protocol. PCR products were purified and sequenced at BaseClear B.V. (www.baseclear.com) using the amplification primers. Sequences were assembled and edited using Geneious v8.1.8 (Biomatters Ltd.) and subjected to a BLAST search (Altschul et al. 1990) against the GenBank database (megablast; considering, where possible, BLAST results with E value of 0.0 and query cover >90 %). Sequences are available in GenBank under accession numbers MH028639–MH028646.

To compile an updated list of the lichens of St. Eustatius, literature and internet sources were exhaustively consulted for previous reports and previous collectors were contacted for additional information.

Results and discussion

In total, 126 lichen species (and one identifiable lichenicolous fungus) were found in 243 collections (Table 1). The vast majority (113 species) could be identified to species level based on morphological and chemical characters, even though no identification book exists for any region nearby. However, many species have been described from other islands in the Caribbean, which can be expected to have many species in common. These were often already described in the 19th century and partly never studied again, but illustrations of their types are increasingly available. The authors also had access to various unpublished sources, such as the unpublished keys, descriptions and specimen citation (by H. Sipman) that was the basis of the internet checklist of St. Eustatius lichens and keys to the lichens from Puerto Rico (Harris 1989) and Guadeloupe (Øvstedal 2010), the latter with many illustrations of type and other specimens.
Table 1. Lichenised and lichenicolous fungi recorded in 11 plots on St. Eustatius. Species names in earlier publications are indicated in brackets. Author names are given in Table 2. Plots H1 and H2 are situated in the Northern Hills, M2–M9 on and around the volcano The Quill in the southern part of the island and U1 in the central urban area. Substrates occupied by each taxon are indicated per plot; b: bark, k: limestone, l: leaves, r: siliceous rock, s: soil, w: wood. Asterisks indicate first records for St. Eustatius (asterisks in brackets indicate additional taxa that are not yet identified to species level). Black dots (•) indicate specimens from which DNA was extracted.

| Taxon                                | H1  | H2  | M1  | M2  | M3  | M4  | M5  | M7  | M8  | M9  | U1 |
|--------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| (*): Acanthothecis sp. •             |     |     |     |     |     |     |     |     |     |     |    |
| Alyxia culmigena (Opegrapha herbarum) | r   |     |     |     |     | w   | b   |     |     |     |    |
| *Alyxia varia                        | b   | b   | b   | b   | b   |     |     |     |     |     |    |
| *Amandinea multispora                |     |     |     |     |     | b   |     |     |     |     |    |
| *Anisomeridium subprostans           |     |     |     |     |     | b   |     |     |     |     |    |
| Anisomeridium tamarindii             |     |     |     |     |     | b   |     |     |     |     |    |
| (*): Anisomeridium sp. corticate c. pycnidia • |     |     |     |     |     |     | b   |     |     |     |    |
| *Anisomeridium terminatum            |     |     |     |     |     | b   |     |     |     |     |    |
| Arthonia antillarum                  |     |     |     |     |     | b   |     |     |     |     |    |
| Arthonia caribaea                    | b   | b   | b   | b   | b   |     |     |     |     |     |    |
| Arthonia conferta                    |     | b   | b   | b   | b   | b   | b   |     |     |     |    |
| Arthonia cryptodes                   |     |     |     |     |     | b   |     |     |     |     |    |
| Arthonia minuta                      | b   |     |     |     |     | b   |     |     |     |     |    |
| *Arthonia paraspillarum              | b   | b   |     |     |     |     |     |     |     |     |    |
| Arthothelium macrothecum             | b   | b   |     |     |     |     |     |     |     |     |    |
| *Bacidia medialis                    | b, r r |     |     |     |     |     |     |     |     |     |    |
| (*): Bacidia sp. apotheciate •       | b, w b |     |     |     |     |     |     |     |     |     |    |
| (*): Bacidia sp. sorediate •         |     |     | b   |     |     |     |     |     |     |     |    |
| Bactrospora denticulata              | b   | b   | b   | b   | b   |     |     |     |     |     |    |
| *Bactrospora junikii                 |     |     |     |     |     | b   |     |     |     |     |    |
| *Bogoriella annonacea                | b   | b   |     |     |     |     |     |     |     |     |    |
| *Brigantiaea leucosantha             | b   |     |     |     |     |     |     |     |     |     |    |
| Buellia dejungensi                   | r   | r   | r   | r   | r   |     |     |     |     |     |    |
| *Buellia griseovirens                |     |     |     |     |     | w   | w   |     |     |     |    |
| Buellia mamillana (Buellia glaziouana) |     |     |     |     |     |     |     |     |     |     |    |
| Caloplaca leptozona                  | r   |     |     |     |     |     | r   |     |     |     |    |
| *Caloplaca obscurella                |     |     |     |     |     |     |     |     |     |     | w  |
| Coenogonium linkii                   |     |     | b   | b   |     |     |     |     |     |     |    |
| *Coenogonium saepincola              |     |     |     |     |     |     |     |     |     |     | w  |
| Coenogonium strigosum                |     |     |     |     |     |     |     |     |     |     | b  |
| Coniocarpon cinnabarinum (Arthonia cinnabarinus) |     |     |     |     |     |     |     |     |     |     | b  |
| *Crepnea carneoapruinata             | b, r |     |     |     |     |     |     |     |     |     |    |
| *Crepnea flavia                      |     |     |     |     |     |     |     |     |     |     | r  |
| *Crypotheria punctosorediata         |     |     |     |     |     |     |     |     |     |     | b  |
| Cryptothecia striata                 | b   | b, r |     |     |     |     |     |     |     |     |    |
| (*): Cryptothecia sp. isidiate •     | b   |     |     |     |     |     |     |     |     |     |    |
| (*): Cryptothecia sp. sterile •      | b   |     |     |     |     |     |     |     |     |     |    |
| *Dactylopora saxatilis (lichenicolous on Pertusaria praetervisa) |     |     |     |     |     |     |     |     |     |     | r  |
| Dichoporeiopsis nigrocinctum         | b, r | b   | b   |     |     |     |     |     |     |     |    |
| Taxon                                    | H1 | H2 | M1 | M2 | M3 | M4 | M5 | M7 | M8 | M9 | U1 |
|-----------------------------------------|----|----|----|----|----|----|----|----|----|----|----|
| *Dictyomeridium amylosporum             | b  |    |    |    |    |    |    |    |    |    |    |
| Diorygma hieroglyphicum                 |    |    |    | b  |    |    |    |    |    |    |    |
| Diorygma poitaei                        | b  |    |    |    |    |    |    |    |    |    |    |
| *Diorygma pruinoum                      | b  |    |    |    |    |    |    |    |    |    |    |
| *Endocarpon pallidulum                  | r  |    |    | r  | k  | s  | r  |    |    |    |    |
| Enterographa pallidella                 | b  |    |    |    |    |    |    |    |    |    |    |
| Enterographa subserialis                | b  |    |    |    |    |    |    |    |    |    |    |
| Flakea papillata                        | b  |    |    | b  | r  | w  | b  | r  | r  |    |    |
| Glyphis scyphulifera                    | b  |    |    |    |    |    |    |    |    |    |    |
| Graphis caesiella                       | b  |    |    |    |    |    |    |    |    |    |    |
| *Graphis cincta                        | b  |    |    |    |    |    |    |    |    |    |    |
| Graphis dendrogramma                    | b  |    |    | b  |    |    |    |    |    |    |    |
| *Graphis librata                        | b  |    |    |    |    |    |    |    |    |    |    |
| Gyrolechia basiae (Caloplaca basiae)    |    | b  |    | b  | r  |    |    |    |    |    |    |
| *Hafellia curtellae                    | b  |    |    |    |    |    |    |    |    |    |    |
| Hyperphyscia adglutinata                | b  |    |    |    |    |    |    |    |    | b  |    |
| Lathagrium neglectum (Collema neglectum)|    |    |    |    |    |    |    |    |    |    | b  |
| Lecanora legalloana                     | r  |    | r  | r  | r  | r  |    |    |    |    |    |
| *Lecanora leproplaca                    | b  |    |    | b  |    |    |    |    |    |    |    |
| Lecanora leprosa                        |    |    |    |    |    |    |    |    |    |    | r  |
| Lecanora prosecha                       | r  | r  |    | r  | r  | r  | r  |    |    |    |    |
| Lecanora sulfurescens                   | r  |    |    |    |    |    |    |    |    |    |    |
| *Leparia fmkii                          | b  |    |    |    |    |    |    |    |    |    |    |
| *Leprocollema nova-caledonianum         |    |    |    |    |    |    |    |    |    |    | w  |
| Letrouitia domingensis                  | b  |    |    |    |    |    |    |    |    |    |    |
| Malmidea piperis (Malcolmia piperis)    | b  |    |    |    |    |    |    |    |    |    |    |
| *Malmidea psychotrioides                | b  |    |    |    |    |    |    |    |    |    |    |
| Malmidea vinosa (Malcolmia vinosa)      | b  |    |    |    |    |    |    |    |    |    |    |
| Mazania carnea (Mazania ocellata)       | b  | b  |    |    |    |    |    |    |    |    |    |
| (*)Melaspilea sp. (licheniculous on Pyrenula dissimulans) | b  |    |    |    |    |    |    |    |    |    |    |
| *Microtheliopsis ulana                  | l  |    |    |    |    |    |    |    |    |    |    |
| *Mycoporium eschweileri                 |    |    | b  | b  |    |    |    |    |    |    |    |
| Nyungwea anguinella (Enterographa anguinella) |    |    |    |    |    |    |    |    |    | b  |    |
| *Opegrapha atraea                       | b  | b  |    |    |    |    |    |    |    |    |    |
| *Opegrapha lathyrygza                   | r  |    |    |    |    |    |    |    |    |    |    |
| *Opegrapha quintana                    | b  |    |    |    |    |    |    |    |    |    |    |
| (*)Opegrapha sp.                       |    |    |    |    | k  |    |    |    |    |    |    |
| Pelula bolanderi                        | r  |    |    |    |    |    |    |    |    |    |    |
| Pelula obscurans                        | r  |    |    | r  |    |    |    |    |    |    |    |
| Pertusaria coccopoda                    | r  |    |    | r  |    |    |    |    |    |    |    |
| Pertusaria praetervisa                  | r  | r  |    |    |    |    |    |    |    |    |    |
| *Pertusaria texana                      | b  |    |    |    |    |    |    |    |    |    |    |
| Pertusaria xanthodes                    | b  |    |    |    |    |    |    |    |    |    |    |
| *Phaeographis cripata                   | b  |    |    |    |    |    |    |    |    |    |    |
| Phaeographis dendritica                 | b  |    |    |    |    |    |    |    |    |    |    |
| *Phyllopeltula corticola                | b  |    |    |    |    |    |    |    |    |    |    |
| Phyllopora corallina                    | b  |    |    | b  | r  | r  |    |    |    |    |    |
| Physcia astrotria                       | b  |    |    |    |    |    |    |    |    |    |    |
Somewhat to the authors’ surprise, as many as 54 (almost 50 %) of the identified species are new records for St. Eustatius. This includes mostly relatively common and widespread tropical or Neotropical species, but also some rare species, notably *Staurolemma dussii* (Vain.) P.M. Jørg. & Henssen, which was so far only known from its type from Guadeloupe. Furthermore, it is remarkable that *Cresponea flava* (Vain.) Egea & Torrente was found on siliceous rock. The presence of so many additional species within the limited surface area of the plots, totalling 6875 m$^2$ (0.03% of the total island surface), suggests that the exploration of the lichen flora of St. Eustatius has not yet been

| Taxon                          | H1 | H2 | M1 | M2 | M3 | M4 | M5 | M7 | M8 | M9 | U1 |
|-------------------------------|----|----|----|----|----|----|----|----|----|----|----|
| *Physcia erumpens*            |    |    |    |    |    |    |    |    |    |    |    |
| *Physcia integrata*           |    |    |    |    |    |    |    |    |    |    |    |
| Physcia sorediosa             |    |    |    |    |    |    |    |    |    |    |    |
| *Porina compressa*            | b  | r  |    |    |    |    |    |    |    |    |    |
| Porina epiphylla              | l  |    |    |    |    |    |    |    |    |    |    |
| Porina internigrans           | b  | b  |    |    |    |    |    |    |    |    |    |
| *Porina leptalea*             | r  |    |    |    |    |    |    |    |    |    |    |
| Porina nucula                 | b  | r  |    |    |    |    |    |    |    |    |    |
| *Porina rubentior*            | l  |    |    |    |    |    |    |    |    |    |    |
| Porina tetracerae             | b  | b  | r  |    |    |    |    |    |    |    |    |
| *Porina thaxteri*             | l  |    |    |    |    |    |    |    |    |    |    |
| (*) Porotrichia cf. americana | r  |    |    |    |    |    |    |    |    |    |    |
| *Pyrenopsis antillarum*       | r  |    |    |    |    |    |    |    |    |    |    |
| *Pyrenula adacta*             | b  | b  | b  | b  |    |    |    |    |    |    |    |
| Pyrenula breutelii (*Pyrenula macularis*) |    |    |    |    |    |    |    |    |    |    |    |
| Pyrenula coccodes             | b  | b  | b  | b  |    |    |    |    |    |    |    |
| *Pyrenula cruenta*            | b  |    |    |    |    |    |    |    |    |    |    |
| *Pyrenula dissimulans*        | b  | b  | b  | b  | b  |    |    |    |    |    |    |
| Pyrenula nitidula             | b  |    |    |    |    |    |    |    |    |    |    |
| Pyxine coccoides              | b  | b  | b  | b  | b  |    |    |    |    |    |    |
| *Ramalina stoffersii*         | r  |    |    |    |    |    |    |    |    |    |    |
| *Rinodina antillarum*         | r  |    |    |    |    |    |    |    |    |    |    |
| *Rinodina colobinoides*       | b  | b  |    |    |    |    |    |    |    |    |    |
| Rinodina pyxinoides           | r  | r  | r  | r  | r  | r  | r  |    |    |    |    |
| Sarcographa cf. tricosa •     |    |    |    |    |    |    |    |    |    |    |    |
| Squamulae subsoluta (*Caloplaca subsoluta*) | r  | r  | r  | r  |    |    |    |    |    |    |    |
| *Staurolemma dussii*          | b  |    |    |    |    |    |    |    |    |    |    |
| *Sticta xanthotropa*          | r  | r  |    |    |    |    |    |    |    |    |    |
| *Stigmatochromma gerontoides* | w  |    |    |    |    |    |    |    |    |    |    |
| (*) Stigmidium cf. schaereri  | k  |    |    |    |    |    |    |    |    |    |    |
| *Strigula decipiens*          | r  |    |    |    |    |    |    |    |    |    |    |
| *Strigula phaea*              | b  | r  |    |    |    |    |    |    |    |    |    |
| Strigula squaragula           | l  |    |    |    |    |    |    |    |    |    |    |
| *Syciesia decussans*          | b  |    |    |    |    |    |    |    |    |    |    |
| *Thelenella luridella*        | r  | r  | r  |    |    |    |    |    |    |    |    |
| (*) Thelidium cf. decipiens * | k  |    |    |    |    |    |    |    |    |    |    |
| (*) Verrucaria cf. dolosa *   | r  |    |    |    |    |    |    |    |    |    |    |
| *Verrucaria nigrescens*       | r  |    |    |    |    |    |    |    |    |    |    |
| (*) Wetmoreana cf. appressa * | r  |    |    |    |    |    |    |    |    |    |    |

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exhaustive. However, no clearly undescribed species were found in the material and the number of species described based on material from St. Eustatius remains low with two, *Viz. Stirtonia neotropica* (Aptroot 2009) and *Synesia subintegra* (Sipman 2009).

Several specimens could not be identified with certainty in the present material but represent additional species (and in several cases additional genera). These are, for instance, Lichinaceae and Verrucariaceae, of which the taxonomy of the tropical taxa is incompletely known. Rather than describing them as new, they were listed with the name of the species that is morphologically most similar, preceded by “cf”. The BLAST results from the mtSSU sequences obtained from eight of these specimens in most cases allowed preliminary insights into their phylogenetic position.

The sequence of the *Anisomeridium* specimen with only conidia from St. Eustatius receives the highest BLAST hits with other representatives of the Monoblastiaceae in Nelsen et al. (2009, 2011), *Viz. Anisomeridium ubianum* (Vain.) R.C. Harris, *A. cf. wileyanum* (R.C. Harris) R.C. Harris, *Megalotremis verrucosa* (Makhija & Patw.) Aptroot and *Trypetheliopsis kalbii* (Lücking & Sérus.) Aptroot. The low sequence identities of 86−93 % clearly indicate that the St. Eustatius specimen belongs to another species in that family, but too few mtSSU sequences are yet available for a more precise molecular identification.

In the Graphidaceae, the top five BLAST hits for the specimen of *Acanthothecis* sp. were all with *Acanthothecis peplophora* (M. Wirth & Hale) E. Tripp & Lendemer specimens (97 % identity), whereas the identity with the sequence of the type species of *Acanthothecis, A. hololeucoides* (Nyl.) Staiger & Kalb, was only 89 %. The specimen from St. Eustatius thus most probably does not belong to *Acanthothecis* s.str., but may represent a species of ‘*Acanthothecis 2’* in the *Carbacanthographis* clade (cf. Rivas Plata et al. 2013, Medeiros et al. 2017). The *Sarcographa cf. tricosa* specimen received BLAST hits of 97 % identity with *Sarcographina glyphiza* (Nyl.) Kr.P. Singh & D.D. Awasthi and *Palloidogramme chlorocarpoides* (Nyl.) Staiger, Kalb & Lücking, both situated in the Graphioideae tribe Graphidae p.p. clade of Rivas Plata et al. (2013). However, another GenBank sequence of *P. chlorocarpoides*, as well as several species of other genera of same clade, were 96 % identical, including the single other specimen of *S. tricosa* in GenBank (but not the species of the *Sarcographa* s.str. clade sensu Rivas Plata et al. 2013). The identity of the St. Eustatius specimen thus remains ambiguous based on the presently available mtSSU sequence data.

Both the apotheciate and sorediate *Bacidia* specimens are closest to sequences of species of the *Toninia-Bacidia* p.p. clade in Miadlikowska et al. (2014), the former to *Toninia sedifolia* (Scop.) Timdal (94 % identity) and the latter to *Bacidia californica* S. Ekman and *B. phacodes* Körb. (88−89 % identity), respectively. Consequently, they do not belong to *Bacidia* s.str., which forms a separate clade (including the type species, *B. rosella* (Pers.) De Not.) in Miadlikowska et al. (2014).

In the Verrucariaceae, *Verrucaria* was resolved as polyphyletic and *Thelidium* mixed with *Polyblastia, Staurothele* p.p. and *Verrucaria* p.p. (*Polyblastia* clade) in molecular phylogenetic reconstructions (Gueidan et al. 2007, Muggia et al. 2010, Thüs et al. 2011). The sequence of the *Thelidium cf. decipiens* specimen from St. Eustatius, how-
**Table 2.** Updated checklist of the lichens of St. Eustatius.

| Species | References |
|---------|------------|
| **Lichens** | |
| Acarospora chrysops (Tuck.) H.Magn. | Boom et al. (2009) as Acarospora dissipata H.Magn. |
| Alyxia varia (Pers.) Ertz & Tehler | present study |
| Alyxia ochrocheila (Nyl.) Ertz & Tehler | Boom et al. (2009) as Opegrapha herbarum Mont., present study |
| Alyxia variabilis (Müll. Arg.) Marbach | Boom et al. (2009) |
| Amandinea efflorescens (Müll. Arg.) Marbach | Boom et al. (2009) |
| Amandinea multispora (Kalb & Vězda) Marbach | present study |
| Amandinea propinquus (Nyl.) Elix & H. Maybofer | Boom et al. (2009) as Buellia propinquus (Nyl.) Riddle |
| Anisomeridium americum (A.Massal.) R.C. Harris | Boom et al. (2009) |
| Anisomeridium americum (A.Massal.) R.C. Harris | Boom et al. (2009), Harris (1995) |
| Anisomeridium subprostans (Nyl.) R.C. Harris | present study |
| Anisomeridium terminatum (Nyl.) R.C. Harris | Boom et al. (2009), present study |
| Anisomeridium tamarindii (Fée) R.C. Harris | Boom et al. (2009) |
| Anisomeridium tamarindii (Fée) R.C. Harris | Boom et al. (2009) |
| Anisomeridium tamarindii (Fée) R.C. Harris | Boom et al. (2009) |
| Anisomeridium tamarindii (Fée) R.C. Harris | Boom et al. (2009) |
| Anisomeridium tamarindii (Fée) R.C. Harris | Boom et al. (2009) |
| Arthonia antillarum (Fée) Nyl. | Boom et al. (2009), present study |
| Arthonia caribaea (Ach.) A. Massal. | Boom et al. (2009), present study |
| Arthonia conferta (Fée) Nyl. | Boom et al. (2009), present study |
| Arthonia cyanea (Müll. Arg.) | Boom et al. (2009) |
| Arthonia cyrtodes Nyl. | Boom et al. (2009) |
| Arthonia minuta Vain. | Boom et al. (2009), present study |
| Arthonia parviflora A. Massal. | present study |
| Astronthelium macrothecum (Fée) A. Massal. | Boom et al. (2009), present study |
| Astrothelium bicolor (Taylor) A. Massal. | Boom et al. (2009) as Trypethelium nitidiusculum (Nyl.) R.C. Harris, A. Massal. |
| Bogoriella annonacea (Müll. Arg.) | Boom et al. (2009) as Caloplaca cinnabarina (Ach.) Zahlbr. |
| Browniella cinnabarina (Ach.) S.Y. Kondr., Kärnefelt, A. Thell, Elix, J.Kim, A.S.Kondr. & J.-S.Hur | present study |
| Buellia boergesenii Imshaug | Boom et al. (2009) |
| Buellia dejungensi (Nyl.) Vain. | Boom et al. (2009), present study |
| Buellia griseovirens (Turner & Borrer ex Sm.) Almb. | present study |
| Buellia griseovirens (Turner & Borrer ex Sm.) Almb. | present study |
| Buellia majuscula (Tuck.) W.A. Weber | Boom et al. (2009) as Buellia glaziouana (Kremp.) Müll. Arg., present study |
| Buellia posthabita (Nyl.) Zahlbr. | Boom et al. (2009) |
| Bulbothrix scortella (Nyl.) Hale | Boom et al. (2009) |
| Bulbothrix suffixa (Stirt.) Hale | Boom et al. (2009) |
| Byssoloma leucoblepharum (Nyl.) Vain. | Boom et al. (2009) |
| Caloplaca diplacia (Ach.) Riddle | Boom et al. (2009) |
| Caloplaca leptozona (Nyl.) Zahlbr. | Boom et al. (2009), present study |
| Caloplaca obscura (Th. Fr.) J. Lahm | present study |
| Canoparmelia martinicana (Nyl.) Elix & Hale | Boom et al. (2009) |
| Carbacanthographis triphoroides (M. Wirth & Hale) Lücking | Boom et al. (2009) |
| Species | References |
|---------|------------|
| Chapsa cinchonarum (Fée) Frisch | Boom et al. (2009) |
| Chrysothrix xanthina (Vain.) Kalb | Boom et al. (2009) |
| Cladonia corymbites Nyl. | Boom et al. (2009) |
| Cladonia didyma (Fée) Vain. | Boom et al. (2009) |
| Cladonia subradiata (Vain.) Sandst. | Boom et al. (2009) |
| Coccocarpia palmicola (Spreng.) Arc. & D.J. Galloway | Boom et al. (2009) |
| Coccocarpia pelletia (Ach.) Müll. Arg. | Boom et al. (2009) |
| Coenogonium interpositum Nyl. | Boom et al. (2009) |
| Coenogonium leprieurii (Mont.) Nyl. | Boom et al. (2009) |
| Coenogonium linkii Ehrenb. | Boom et al. (2009) |
| Coenogonium saepincola Aptroot, Sipman & Lücking | present study |
| Coenogonium strigosum Rivas Plata, Lücking & Chaves | Boom et al. (2009), present study |
| Coenogonium subdilutum (Malme) Lücking, Aptroot & Sipman | Boom et al. (2009) |
| Coniocarpon cinnabarinum DC. | Boom et al. (2009) as Arthonia cinnabarina (DC.) Wallr., present study |
| Cryptothecia carneolutea (Tuck.) A. Massal. | Boom et al. (2009) |
| Cryptothecia megalocarpa (Müll. Arg.) R. Sant. | Boom et al. (2009) |
| Cryptothecia punctosorediata Sparrius | present study |
| Cryptothecia striata G. Thor | Boom et al. (2009), present study |
| Dichophoridium nigrocinctum (Ehrenb.) G. Thor | Boom et al. (2009), present study |
| Dictyomeridium amylosporum (Vain.) Aptroot, M.P. Nelsen & Lücking | present study |
| Dirina paradoxa (Fée) Tehler | Boom et al. (2009) as Divina approximata subsp. hioramii (B. de Lesd.) Tehler, Tehler et al. (2013) |
| Diviniaaria aegialita (Ach.) B.J. Moore | Boom et al. (2009) |
| Endocarpon pallidulum (Nyl.) Nyl. | present study |
| Enterographa compunctula (Nyl.) Redinger | Boom et al. (2009) |
| Enterographa multilocularis (Müll. Arg.) Sparrius | Boom et al. (2009) |
| Enterographa pallidella (Nyl.) Redinger | Boom et al. (2009), present study |
| Enterographa perez-biaredae Herrera-Camp. & Lücking | Boom et al. (2009) |
| Enterographa sipmanii Sparrius | Boom et al. (2009) |
| Enterographa subserialis (Nyl.) Redinger | Boom et al. (2009), present study |
| Eremothecella microcephalica Sipman | Boom et al. (2009) |
| Fissurina dumastii Fée | Boom et al. (2009) |
| Flakea papillata O.E. Erikss. | Boom et al. (2009), present study |
| Glyphis cicatricosa Ach. | Boom et al. (2009) |
| Glyphis scyphulifera (Ach.) Staiger | Boom et al. (2009), present study |
| Graphis caesiella Vain. | Boom et al. (2009), present study |
| Graphis chondrophylla (Redinger) Lücking | Boom et al. (2009) |
| Graphis cincta (Pers.) Aptroot | present study |
| Species                        | References                                    |
|-------------------------------|-----------------------------------------------|
| *Graphis dendrogramma* Nyl.   | Boom et al. (2009), present study              |
| *Graphis furcata* Fée         | Boom et al. (2009)                            |
| *Graphis glaucescens* Fée     | Boom et al. (2009)                            |
| *Graphis librata* C. Knight   | present study                                 |
| *Graphis lineola* Ach.        | Boom et al. (2009)                            |
| *Graphis tenella* Ach.        | Boom et al. (2009)                            |
| *Graphis tenellula* Vain.     | Boom et al. (2009)                            |
| *Gyalectidium filicinum* Müll. Arg. | Boom et al. (2009)                     |
| *Gyalolechia bassiae* (Ach.) Sochting, Frödin & Arup ex Ahl | Boom et al. (2009) as *Caloplaca bassiae* (Ach.) Zahlbr., present study |
| *Hafellia bahiana* (Malme) Sheard | Boom et al. (2009)                             |
| *Hafellia curvatellae* (Malme) Marbach | present study                                |
| *Heterodermia albicans* (Pers.) Swinscow & Krog | Boom et al. (2009)                            |
| *Heterodermia galactophylla* (Tuck.) W.L. Culb. | Boom et al. (2009)                            |
| *Heterodermia lutescens* (Kurok.) Follmann | Boom et al. (2009)                            |
| *Heterodermia obscurata* (Nyl.) Trevis. | Boom et al. (2009)                            |
| *Heterodermia squamulosa* (Degel.) W.L. Culb. | Boom et al. (2009)                            |
| *Heterodermia verrucifera* (Kurok.) W.A. Weber | Boom et al. (2009)                            |
| *Hyperphyscia adglutinata* ( Förke) H. Mayrhofer & Poelt | Boom et al. (2009), present study             |
| *Hyperphyscia minor* (Fée) D.D. Awarshi | Boom et al. (2009)                            |
| *Lathrigostrum neglectum* (Degel.) Otárola, P.M. Jörg. & Wedin | Boom et al. (2009) as *Collema neglectum* Degel., present study |
| *Lecanactis epiluca* (Nyl.) Tehler | Boom et al. (2009)                             |
| *Lecanora galactiniza* Nyl.    | Boom et al. (2009)                            |
| *Lecanora legalloana* Elix & Øvstedal | Boom et al. (2009), present study              |
| *Lecanora leproplaca* Zahlbr. | present study                                 |
| *Lecanora leprosa* Fée        | Boom et al. (2009), present study              |
| *Lecanora proemcha* Ach.      | Boom et al. (2009), present study              |
| *Lecanora sulfurescens* Fée   | Boom et al. (2009), present study              |
| *Leitodictyon exaltatum* (Mont. & Bosch) Staiger | Boom et al. (2009)                            |
| *Lepraria finkii* (B. de Lesd.) R.C. Harris | present study                                 |
| *Leprocollema novacaledonianum* (A.L. Sm.) | present study                                 |
| *Letrouitia domingensis* (Pers.) Hafellner & Bellem. | Boom et al. (2009), present study              |
| *Leucodictyon bisporum* (Nyl.) Sipman & Lücking | Boom et al. (2009)                            |
| *Leucodictyon compactum* (Ach.) A. Massal. | Boom et al. (2009)                            |
| *Loefschmittia wallishii* (Müll. Arg.) Vezda | Boom et al. (2009)                            |
| *Malniidea piperis* (Spreng.) Kalb, Rivas Plata & Lumbsch | Boom et al. (2009) as *Malcolmiella piperis* (Spreng.) Kalb & Lücking, present study |
| *Malniidea psychotrioides* (Kalb & Lücking) Kalb, Rivas Plata & Lumbsch | present study                                  |
| *Malniidea vinosa* (Eschw.) Kalb, Rivas Plata & Lumbsch | Boom et al. (2009) as *Malcolmiella vinosa* (Eschw.) Kalb & Lücking, present study |
| *Mazosia carnea* (Eckfels) Aptroot & M. Cáceres | Boom et al. (2009) as *Mazosia ocellata* (Nyl.) R.C. Harris, present study |
| *Mazosia phylloena* (Nyl.) Zahlbr. | Boom et al. (2009)                            |
| *Megalaria bengalensis* Jagadeesh Ram & Aptroot | Hensen (BR)                                    |
| *Melanotrema meiospermum* (Nyl.) Frisch | Boom et al. (2009)                            |
| *Microtheliopsis uleana* Müll. Arg. | present study                                 |
| Species | References |
|---------|------------|
| *Mycoporum eschweileri* (Müll. Arg.) R.C. Harris | present study |
| *Myriostigma candidum* Krem. | Boom et al. (2009) as *Cryptothecia candida* (Kremp.) R. Sant.: incorrect report |
| *Myriotrema myriotremoides* (Nyl.) Hale | Boom et al. (2009) |
| *Nyungwea anguinella* (Nyl.) Aptroot | Boom et al. (2009) as *Enterographa anguinella* (Nyl.) Redinger, present study |
| *Ocellularia depressa* (Mont.) Hale | Boom et al. (2009) |
| *Ocellularia interposita* (Nyl.) Hale | Boom et al. (2009) |
| *Ocellularia terebrata* (Ach.) Müll. Arg. | Boom et al. (2009) |
| *Opographa astraea* Tuck. | present study |
| *Opographa lithyriza* Vain. | present study |
| *Opographa quintana* Tuck. | present study |
| *Pannaria prolifica* Vain. | Boom et al. (2009) |
| *Parmotrema crinitum* (Ach.) M. Choisy | Boom et al. (2009) |
| *Parmotrema endosulphureum* (Hillmann) Hale | Boom et al. (2009) |
| *Parmotrema praesorediosum* (Nyl.) Hale | Boom et al. (2009) |
| *Parmotrema tinctorum* (Nyl.) Hale | Boom et al. (2009) |
| *Peltula bolanderi* (Tuck.) Wetmore | Boom et al. (2009), present study |
| *Peltula oblonga* (Nyl.) Gyeln. | Boom et al. (2009), present study |
| *Peltula octomera* (Müll. Arg.) Fée | Boom et al. (2009), present study |
| *Phaeographis scalpturata* (Ach.) Staiger | Boom et al. (2009) |
| *Phlyopeltula corticola* (Büdel & R. Sant.) Kalb | present study |
| *Physcia atrostriata* Moberg | Boom et al. (2009), present study |
| *Physcia crispa* Nyl. | Boom et al. (2009) |
| *Physcia erumpens* Moberg | present study |
| *Physcia integrata* Moberg | present study |
| *Physcia sinuosa* Moberg | Boom et al. (2009) |
| *Physcia sorediosa* (Vain.) Lyngbe | Boom et al. (2009), present study |
| *Playthecium colliculosum* (Mont.) Staiger | Boom et al. (2009) |
| *Polymeridium quinqueseptatum* (Nyl.) R.C. Harris | Boom et al. (2009) |
| *Porina conspersa* Malme | present study |
| *Porina epiphylla* (Fée) Fée | Boom et al. (2009), present study |
| *Porina intermagna* (Nyl.) Müll. Arg. | Boom et al. (2009) |
| *Porina leptalea* (Durieu & Mont.) A.L. Sm. | present study |
| *Porina maioidea* (Ach.) Müll. Arg. | Hensen (BR), Boom et al. (2009) |
| *Porina nitidula* Müll. Arg. | Boom et al. (2009) |
| *Porina nucula* Ach. | Boom et al. (2009), present study |
| *Porina octomera* (Müll. Arg.) E.Schill. | Boom et al. (2009) |
| Species                                                      | References                                      |
|--------------------------------------------------------------|------------------------------------------------|
| *Porina rubentior* (Stirt.) Müll. Arg.                       | present study                                  |
| *Porina tetragonae* (Ach.) Müll. Arg.                       | Boom et al. (2009), present study              |
| *Porina thecateri* R. Sant.                                 | present study                                  |
| *Pseudochapsa dilatata* (Müll. Arg.) Parnmen, Lücking & Lumbsch | Boom et al. (2009) as *Chapsa dilatata* (Müll. Arg.) Kalb |
| *Pseudopyrenula subgregaria* Müll. Arg.                     | Boom et al. (2009)                             |
| *Pseudopyrenula subnodulata* Müll. Arg.                     | Harris (1998) as *Pseudopyrenula dilata* (Fée) Müll. Arg. var. *degenerans* Vain, Boom et al. (2009) as *Pseudopyrenula dilata*, Aptroot and Lücking (2016) |
| *Pyrenopsis antillarum* Vain.                               | present study                                  |
| *Pyrenula adacta* Fée                                        | present study                                  |
| *Pyrenula astroida* (Fée) R.C. Harris                       | Boom et al. (2009)                             |
| *Pyrenula bahiana* Malme                                     | Boom et al. (2009) as *Pyrenula concatenans* (Nyl.) R.C. Harris |
| *Pyrenula breutelii* (Müll. Arg.) A. P. Aptroot              | Boom et al. (2009) as *Pyrenula macularis* (Zahlbr.) R.C. Harris, present study |
| *Pyrenula cinerea* Zahlbr.                                   | Boom et al. (2009)                             |
| *Pyrenula cocoes* Müll. Arg.                                | Boom et al. (2009), present study              |
| *Pyrenula confinis* (Nyl.) R.C. Harris                      | Boom et al. (2009)                             |
| *Pyrenula cruenta* (Mont.) Vain.                            | present study                                  |
| *Pyrenula disimilans* (Müll. Arg.) R.C. Harris              | present study                                  |
| *Pyrenula duplicans* (Nyl.) A. P. Aptroot                   | Boom et al. (2009)                             |
| *Pyrenula leucostoma* Ach.                                  | Boom et al. (2009)                             |
| *Pyrenula mamillana* (Ach.) Trevis.                         | Boom et al. (2009) as *Pyrenula xyloides* (Eschw.) Müll. Arg. |
| *Pyrenula masariopora* (Starbäck) R.C. Harris               | Boom et al. (2009)                             |
| *Pyrenula microtheca* R.C. Harris                           | Boom et al. (2009)                             |
| *Pyrenula nitidula* (Bres.) R.C. Harris                     | Boom et al. (2009), present study              |
| *Pyrenula septicularis* (Eschw.) R.C. Harris                | Boom et al. (2009)                             |
| *Pycine cocos* (Sw.)                                        | Boom et al. (2009), present study              |
| *Ramalina anceps* Nyl.                                      | Boom et al. (2009)                             |
| *Ramalina complanata* (Sw.) Ach.                            | Boom et al. (2009)                             |
| *Ramalina dendroides* (Nyl.) Nyl.                           | Boom et al. (2009)                             |
| *Ramalina furcellata* (Ach.) Zahlbr.                        | Boom et al. (2009)                             |
| *Ramalina stoffersii* Sipman                                | present study                                  |
| *Rinodina antillarum* Vain.                                 | present study                                  |
| *Rinodina colobinoides* (Nyl.) Müll. Arg.                   | present study                                  |
| *Rinodina psycinoides* Vain.                                | Boom et al. (2009), present study              |
| *Rockella gracilis* Bory                                    | Boom et al. (2009), Aptroot and Schumm (2011) |
| *Roccellographa circumscripta* (Leight.) Ertz & Tehler      | Boom et al. (2009) as *Peterjamesia circumscripta* (Taylor) D. Hawksw. |
| *Sarcographa heterocita* (Mont.) Zahlbr.                     | Boom et al. (2009)                             |
| *Sarcographa labyrinthica* (Ach.) Müll. Arg.                | Boom et al. (2009)                             |
| *Sarcographa ramificans* (Kremp.) Staiger                   | Boom et al. (2009)                             |
| *Sarcographa tricosa* (Ach.) Müll. Arg.                     | Boom et al. (2009), present study              |
| *Selrophyton elegans* Eschw.                                | Boom et al. (2009)                             |
| *Sclerophyton trinidadense* Sparrius                        | Boom et al. (2009)                             |
| *Sporopodium phloeochora* (Mont.) A. Massal.                 | Boom et al. (2009)                             |
| *Squamulea subolusta* (Nyl.) Arup, Sochting & Frödén        | Boom et al. (2009) as *Caloplaca subolusta* (Nyl.) Zahlbr., present study |
| *Staurolemma duessii* (Vain.) P.M. Jørg. & Henssen          | present study                                  |
| *Stegobolus auberianus* (Mont.) Frisch & Kalb                | Boom et al. (2009)                             |
| *Stegobolus granulosus* (Tück.) Frisch                      | Boom et al. (2009)                             |
| *Stegobolus subcavatus* (Nyl.) Frisch                       | Boom et al. (2009)                             |
| *Sticta xanthotropa* (Kremp.) D.J. Galloway                 | Hensen (BR), present study                     |
Species                                      References

Stigmatochroma gerontoides (Stirt.) Marbach  present study
Sirtoria neotropica Aptom                                          
Sirtigula decipiens (Malme) P.M. McCarthy  present study
Sirtigula macrospora Vain.                                      Boom et al. (2009)
Sirtigula nemathora Mont.                                       Boom et al. (2009)
Sirtigula obducta (Müll. Arg.) R.C. Harris                     Boom et al. (2009)
Sirtigula phaea (Ach.) R.C. Harris                             Boom et al. (2009)
Sirtigula smaragdula Fr.                                       Boom et al. (2009), present study
Synalissa lichinella Vain.                                     Boom et al. (2009)
Synecia decusata (Nyl.) Tehler                                present study
Synecia farinacea (Fée) Tehler                                Boom et al. (2009), Sipman (2009)
Synecia glyphysoides (Fée) Tehler                             Tehler (1997), Boom et al. (2009), Sipman (2009)
Synecia graphica (Fr.) Tehler                                 Boom et al. (2009), Sipman (2009)
Synecia subintegra Sipman                                      Boom et al. (2009), Sipman (2009)
Teloschistes flavicans (Sw.) Norman                            Boom et al. (2009) as Teloschistes flavicans var. crocea (Ach.) Müll. Arg.

Thalloloma hylosteum (Nyl.) Staiger  
Thelenella luridella (Nyl.) H. Mayrhofer  present study
Thelotrema porinoides Mont. & Bosch                      Boom et al. (2009)
Toninia submexicana B. de Lesd.                              Boom et al. (2009)
Trabesiella caeretata (Sm.) M. Choisy                        Boom et al. (2009)
Usnea baileyi (Stirt.) Zahlb.                                  Boom et al. (2009)
Vierocellaria velata (Turner) I. Schmitt & Lumbsch            Boom et al. (2009)
Verrucaria nigrescens Pers.                                    present study
Xanthoparmelia succedans Eliis & J. Johnst.                  Boom et al. (2009)

Lichenicolous fungus

Dactylospora saxatilis (Schaer.) Hafellner (lichenicolous on Pertusaria praetervisa)  present study

Additional genera (species uncertain)

Acanthothecis sp.                                                present study
Bacidina sp.                                                     present study
Melaspilea sp. (lichenicolous fungus)                           present study
Psorotrichia sp.                                                 present study
Stigmidium sp. (lichenicolous fungus)                           present study
Thelidium sp.                                                    present study
Wetmoreana sp.                                                   present study

ever, is closest to the Catapyrenium-Placidiopsis-Verrucaria p.p. (V. caerulea DC., V. praetermissa (Trevis.) Anzi) clade (Muggia et al. 2010) with sequence identities of 96–97 %. The placement of the Verrucaria cf. dolosa specimen is more difficult to assess, since its sequence shows lower similarities of 92–94 % to representatives of different Verrucarieae genera, such as Agonimia, Bagliettoa and Verrucaria spp.

Finally, the mtSSU sequence of the Wetmoreana cf. appressa specimen from St. Eustatius is difficult to interpret, since it matches more closely with sequences of the Xanthoriaeae (sequence identity 97–99 %) than with Teloschistioideae, in which Wetmoreana is placed (e.g. Arup et al. 2013).

The lichen flora of St. Eustatius can be characterised as lowland, relatively dry Caribbean. As can be seen from Table 1, most species were found on one substratum
type, but some are less specialised. Also, there is a marked difference between the li-
chens of the different plots and the three main areas on St. Eustatius (Northern Hills, 
central urban area, The Quill). However, the authors refrain from performing statisti-
cal comparisons of the lichen diversity between plots, since the number of plots per 
main area differs and is still low and the sampling strategy was devised by specialists of 
other organism groups. Nevertheless, the lichen data will be useful for an island-wide, 
plot-based comparison of diversity amongst all organism groups sampled during the 
2015 inventory.

In Table 2, an updated checklist is presented of the lichens of St. Eustatius, citing 
only identified species, but based on all available sources and with their taxonomy 
(nomenclature and sometimes species concept) updated where necessary. According 
to this list, a total of 263 species are currently known from St. Eustatius. As a side ef-
effect of revising the existing records, one record becomes questionable, viz. *Myriostigma 
candidum* Kremp., which is not known from the Neotropics. It is intended to continue 
the exploration of the lichens of this island in the near future.

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