Articles

Contributions to the lichen flora of Bermuda – Part I. New records, new combinations, and interesting collections of lichenized ascomycetes

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***Abstract*. The last account of the lichen flora of Bermuda was published nearly 100 years ago by Riddle (1916) and repeated in Waterston (1947). The spectrum of species from that time was found to be quite accurate though limited in number. The increasing number of species noted here is predominantly a result of taxonomic progress as well as targeted, intensive exploration of poorly known Bermudian ecosystems. 105 species are recorded as new to Bermuda, and two new combinations are made. *Bacidina varia* Ekman is synonymized with *B. brittoniana* (Riddle) LaGreca & Ekman, and *Lecidea calignosa* Stirton is synonymized with *Malmidea vinosa* (Eschw.) Kalb, Rivas Platas & Lumbsch. A key to *Caloplaca* spp. occurring in Bermuda is provided. The first records of foliicolous lichens of Bermuda are given.**

***Key words*. *Bacidina brittoniana*, Bermuda, foliicolous lichens, lichens, *Muellerella thalamita*.**

INTRODUCTION

According to the most recent survey by Riddle (1916; repeated in Waterston 1947), the British Overseas Territory of Bermuda has 91 species of lichens. This is, perhaps, one of the oldest and infrequently-updated lichen checklists in the world. Why are there so few species known, compared with other, remote archipelagos in the North Atlantic?—the Azores lichen flora, for example, comprises more than 600 species (Rodrigues & Aptroot 2005) while the Canary Islands lichens number over 1000 (Hafellner 1995, 1999, 2002, 2005).

One reason why the number of lichen species in Bermuda is so small is its geology: Bermuda possesses a landscape of soft, aeolian limestone formed from local, windblown sediments of young age (≤ 900,000 years old) derived from coral reefs resting on a sunken volcanic base. The lack of variety in saxicolous substrates and topography (the highest altitude is 79 m), combined with the small size of the islands (roughly 55 km^2 total), has resulted in a restricted diversity of lichen habitats (i.e. vegetation types and saxicolous microhabitats) in contrast to other islands of volcanic or plutonic origins. Furthermore, Bermuda's long history of human disturbance—from the original colonisation over 400 years ago (1609) to today´s 65,000 inhabitants—has caused an extensive loss of native vegetation (Rueger & Von Wallmenich 1996). In addition, the Bermudas are among the most isolated islands in the world: situated 960 km offshore from the nearest landmass (North Carolina, USA), the likelihood of spores (or vegetative propagules) reaching the islands is relatively low. All of these factors contribute to the relatively low number of lichen species in Bermuda.

Bermuda's subtropical climate supports a flora composed of North American and Caribbean biogeographic elements as a result of disperal on the prevailing westerly winds and via the Gulf

Stream, respectively. Thus, many eastern North American species reach their eastern-most range limits in Bermuda, while many Caribbean species reach their northern-most range limits. It is widely known that lichens are very useful for indicating ecosystems with high hemerobie, and indeed lichen species richness on the Bermudas varies according to the ecological continuity of its habitats: it is greatest in undisturbed ecosystems such as mangrove swamps, freshwater ponds and the exterior of protected caves (Berger & LaGreca, pers. obs.).

The authors visited the Bermuda islands from 2004-2009 for a total of about three weeks each. In addition to our own collections, we have re-examined and reviewed some of the historic specimens deposited in BM, FH, H, NY and US (almost all of these are listed in Riddle 1916 and references cited therein). The present paper includes reports of lichens and lichenicolous fungi that we have discovered, thus far, to be new to Bermuda; new to science; and/or in need of recombination. Additional species new to Bermuda and new to science can be found in Aptroot et al. (2008) and Berger and Aptroot (2008). A complete flora of the lichens and lichenicolous fungi of Bermuda, including a thorough review of all historic specimens, will be published as a series of papers, of which this is the first part.

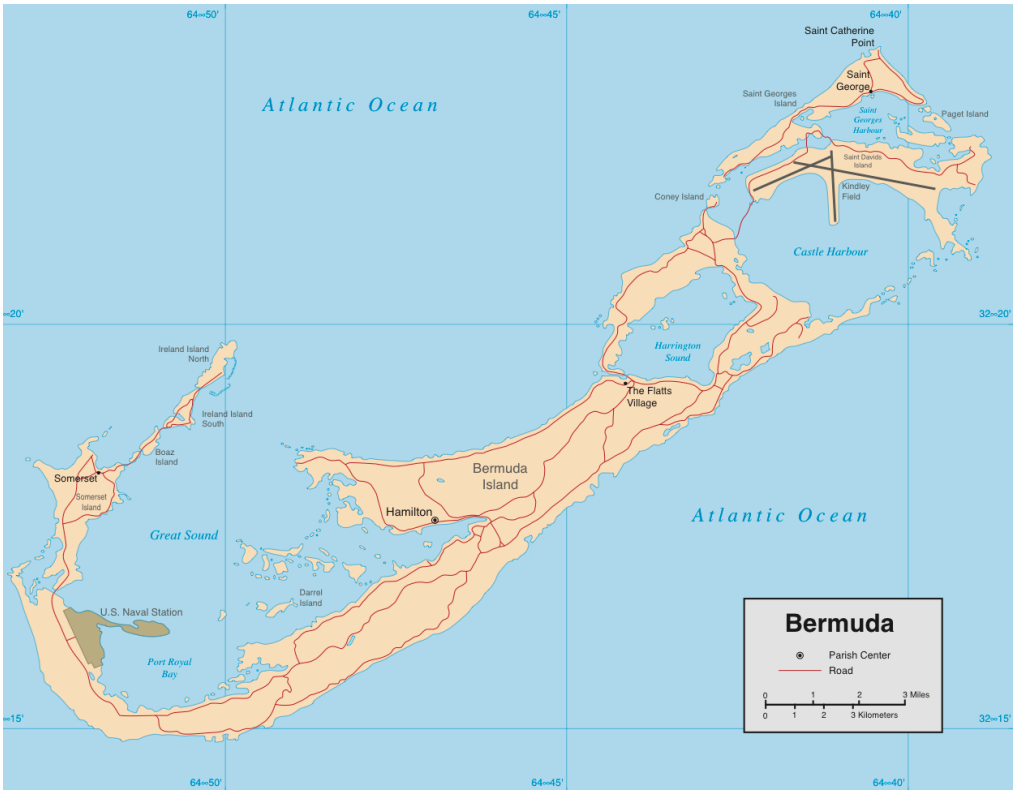

Figure 1. Map of the Bermuda Archipelago, consisting of five main islands connected by bridges.

Natural features

Bermuda is a group of over 130 islands (the "Bermuda Archipelago"), situated at roughly 32°20´N and 64°45´W (Fig. 1). The five biggest islands—all connected by bridges—have the shape of a fish-hook, 40 km long and 1.6 km broad at its widest, with a total area of about 55 km². This main landmass has long, sandy beaches on the southern shore, a rough, rocky coastline along the northern shore, and large saltwater areas surrounded by extensive promontories such as Harrington Sound and Great Sound. The hilly land seldom rises above 60 m altitude (the highest point, The Peak, being 79 m), with most areas being less than 20 m (Herwitz 1992).

Climate

The Bermuda islands have a more subtropical climate than expected considering their position 1000 km north of the tropic of Cancer. This is because Bermuda is warmed by the powerful Gulf Stream, carrying waters from the Gulf of Mexico. Another important feature is a semi-permanent area of high atmospheric pressure, the Azores High, which causes predominantly southern winds in summer. It should be noted here that the exceptionally warm climate accounts for the fact that Bermuda is home to the northernmost coral reefs and mangrove swamps in the world.

There are two seasons in Bermuda, winter and summer. Winter lasts from November to May, and summer from May to October. Temperatures rarely drop below 55° F (minimum 5°C/ 39°F recorded in the winter) or exceed 90° (maximum 35°C/94°F recorded in the summer). The climate ranges from mild, humid and cloud-covered in winter, with an average temperature of 18.5°C (66°F) in February, to uncomfortably hot and humid in summer, with an average temperature of 27°C (81°F). July and August are the most hot and humid months. An average of 53-66 inches (135-168 cm) of rain falls per year; it is distributed fairly evenly throughout the year, although droughts when no rain for an entire month have been recorded. The average annual ocean temperature is 18°C (65°F) but the water temperature can increase to as high as 28°C (83° F) in the summer months (all climate data taken from Forbes 2014). Hurricane season in Bermuda peaks in September; hurricanes strike Bermuda directly every five years and sometimes do considerable damage (the last major storm was "Fabian", a Category 3 Hurricane which hit in September, 2003). Such hurricanes have almost certainly punctuated Bermuda's natural history with devastating extinction events.

Geology

The origin of the islands dates back to a large volcanic eruption in the Mid-Atlantic Ridge in the Cretaceous followed by further volcanic activity in the Tertiary (Vacher & Rowe 1997). About 25 million years ago, the once-enormous volcanic cone eroded from an estimated 3000 m above sea level to 75 m below sea level, causing a complete loss of all terrestrial flora and fauna. Traces of volcanic sands can be found today in Whalebone Bay. From about 5 million years ago, calcareous algae and corals built extensive reef systems on top of the volcanic seamount that is now known as the Bermuda Platform. The oldest terrestrial fossils on Bermuda have been dated to about 900,000 years, which is when the Bermuda Isles as they are known today began to form. Alternating rising and falling sea levels during various Ice Ages during the Holocene exposed and eroded the reefs, and the high winds of the North Atlantic blew the sediments into sand dunes, which eventually petrified into aeolian limestone. Another, older, harder, coral limestone occurs in the Walsingham Jungle; rainfall has slowly dissolved large, subterranean areas of this limestone, producing an extensive system of limestone caves in the Walsingham area. As the porosity of the aeolian limestone is very high, no rivers have formed, which accounts for the invariably crystal-clear blue waters surrounding the islands.

Natural history

An excellent account of the natural history of Bermuda is provided by Thomas (2004). With regards to the vegetation, it is thought that the arrival of humans in 1609 was the beginning of a long and serious modification of forests which had developed for 900,000 years. Before colonisation, Bermuda is supposed to have been covered with more or less continuous forests, dominated by three characteristic endemic trees: the lowland Bermuda Palmetto (*Sabal bermudana*) and the more upland Bermuda Cedar (*Juniperus bermudiana*) and Bermuda Olivewood (*Cassine laneana*), together with other indigenous and now-endangered trees (e.g. *Zanthoxylum flavum* and *Celtis laevigata*) and understory shrubs and herbs. Fossil remains of the Bermuda Palmetto have been dated back to 300,000 years, which supports the theory that Bermudian upland forests were relatively undisturbed for very long periods of time. Mangrove communities, however, disappeared and re-appeared throughout the Holocene as sea levels and temperatures rose and fell with the Ice Ages (Ellison 1996). The most recent alteration of the forests in Bermuda was caused by two accidentally

introduced scale insects in the 1940s, which nearly brought an end to the Bermuda Cedar (Rueger & Von Wallmenich 1996).

Today, only 10% of Bermuda's land area is held in conservation in the form of parks and nature reserves (Thomas 2004). These include small islands such as Nonsuch, coastal mangrove swamps and salt marshes such as Spittal Pond, the south shore beaches such as Horseshoe Bay, and special reserves such as Walsingham Jungle, Devonshire Marsh, and Paget Marsh. Privately owned land adjacent to many of these parks and reserves, however, has often been left undeveloped by private land owners; this almost certainly increases the total preserved natural areas beyond this oft-cited 10% figure. In terms of cryptogams (especially ferns and lichens), Walsingham Jungle is home to the most diverse and important communities (Britton 1918, Berger & Aptroot 2008, Rendle 1936, Waterston 1947).

Lichens

The porous and light nature of the aeolian limestone that is typical of most of the Bermudian landscape is unfavourable for lichen colonisation. Its high porosity and rough surface makes it easy for higher plants to establish themselves, and thus saxicolous lichen communities are shaded out (Berger & LaGreca pers. obs.). In areas where this has not happened, high rates of physical erosion (from tides and storms) seem to have prevented the establishment of complex lichen communities. Like most rocky coastlines in tropical places, the most well-developed supralittoral vegetation zone is the band of cyanobacteria (mostly *Scytonema*, *Chroococcus* and a few other genera) just above high-tide line; there is certainly no complex maritime lichen "zonation" of rocky shores which is so characteristic of north temperate places such as Scandinavia, Great Britain, Maine, USA and Queen Charlotte Islands, Canada (Brodo et al. 2001). Although there are some remarkable, endemic saxicolous lichens found in Bermuda, the saxicolous communities are simply not very well developed. The most remarkable location for saxicolous lichens is the Walsingham Jungle area, in which the oldest and most stable limestone outcrops are found—indeed, there are a number of lichens which are only found in this unique area (Berger & Aptroot 2008; Berger & LaGreca, pers. obs.). It should be noted here that artificial "saxicolous" substrates (such as concrete, mortar or siliceous tombstones, e.g. Paget Cemetery) do not support many lichen species in Bermuda when compared with corticolous and lignicolous substrates (see below). There are exceptions, however: Bermudian records of *Caloplaca holocarpa* and *Bacidia subcircumspecta* are mostly on cement and mortar. In addition, lichens normally found on bark in other parts of Bermuda are commonly found on saxicolous substrates in the treeless Royal Naval Cemetery, where small collections were made during our 2007 trip.

With regards to terricolous lichens, many have probably been extirpated as a result of heavy development and tourism. There are very few dune-fields left in Bermuda; of those that remain (e.g. Stonehole Bay, on Bermuda's south shore), no typical sand lichens (e.g. *Cladonia* or *Cetraria* spp.) could be found (Berger & LaGreca, pers. obs.). One such species, *Cladonia rangiformis*, was reported from Bermuda by Riddle (1916) based on a 19th century collection (!BM, BM barcode no. BM000764738; det. T. Ahti); however, there is uncertainty as to whether it was truly collected from Bermuda (T. Ahti and S. R. Clayden, pers. comm.). If it was, it would be the first record of this species in the New World. Other *Cladonia* species were also reported by Riddle (1916); these will be treated in a future publication in this series. The senior author collected a small specimen of *Cladonia* (*Be 22368*) in the Walsingham Jungle in 2009, but it was so depauperate it could not be determined to species.

Because of the paucity of saxicolous, and virtual lack of terricolous, lichen communities in Bermuda, most of Bermuda's lichen diversity is represented by corticolous species. The virtual disappearance of Bermuda's three endemic tree species in recent centuries possibly caused the extinction of endemic lichens too, which may have obligately occurred on them. This was the explanation given for the extinction of two endemic organisms known only from *Juniperus bermudiana*: the insect *Tibicen bermudiana* (the Bermuda Cicada; Thomas 2004) and the non-lichenized ascomycete *Plectania seaveri* (Carbone et al. 2012), both currently known only from

museum specimens. Today, dead, decorticated *J. bermudiana* trees that have not been cut and burned serve as the only (or almost only) substrate for some unusual Bermudian lichens, including *Bacidia subturgidula*; the recently described *Bactrospora flavopruinosa* (Berger & Aptroot 2008); *Chrysothrix* sp.; *Nadvornikia hawaiiensis*; and *Protoparmelia isidiata*. Because of this, we recommend that removal of dead Bermuda Cedar trees should be strictly prohibited, at least in the Walsingham area and inland marshes.

On the other hand, some corticolous lichen species have probably been introduced along with the many species of non-native, introduced trees planted in Bermuda's numerous gardens and parks. In other words, human activities actually have served to increase colonizable bark and wood substrates.

METHODS

Identifications

There are currently no modern, complete lichen checklists or floras available for any of the Caribbean islands—the islands from which many of Bermuda's lichens may have dispersed from. Brodo et al. (2001), Harris (1995) and Lücking et al. (2011) served as useful guides, but many of our specimens (especially crustose species) were difficult to name. We are very grateful to the many colleagues named in the acknowledgements section of this paper for their assistance with identifications.

An online resource for Bermudian lichens and lichenicolous fungi has been established (LaGreca 2014). This website includes a constantly updated species checklist; recent news about fieldwork and publications; and a compilation of relevant literature references. Eventually, this site will also include a searchable database of Bermudian lichen specimens and keys to species, as well as a discussion forum for the taxonomy and nomenclature of Caribbean lichens.

Collecting sites

As mentioned above, the most species-rich area for lichens in Bermuda is the Walsingham tract with its unique, rugged, old limestone ridges, sinkholes and caves, and the mostly indigenous forest cover over it. Second to Walsingham is Paget Marsh, the most well-conserved inland marsh in Bermuda with a dense mixture of mangroves, Bermuda Palmetto and a mixture of indigenous and invasive bushes. It is also home to many slowly rotting skeletons of *Juniperus bermudiana*, which (as mentioned above) is an important substrate for some lichen species. The third-most species-rich area—one heavily threatened by development—is the fossilized sand dune formation along Elbow Beach, with its coastal wind-bent vegetation, wherein *Coccoloba uvifera* is the most important element. In addition, the hedgerows along the old Railway Trail, dominated by *Eugenia uniflora*, are home to a diverse assemblage of crustose lichens. Special attention was also given to the old churchyards of Paget and Royal Naval Cemetery, Somerset in our search for more saxicolous species. A graph giving percentages of lichen species per collecting site will be provided in the last contribution in this series.

Abbreviations for Berger's collecting sites are given below. LaGreca's collecting sites are spelled out in their entirety, with dates of collections, as part of their specimen citations in the Species List (see Results, below). All collection dates are in the European standard (ie day/month/year).

BM 01: Sandys Parish, Mangrove Bay, Seaview Garden, 5 m, 32°18.2´N – 64°52.36´W; 4.11.2007.

BM 02: Sandys Parish, historical "Royal Naval Cemetery", 2–5 m, 32°18.9´N – 64°50.7´W; 4.11.2007.

BM 03: Southampton Parish: Railway Trail from Southampton to Somerset, on *Casuarina equisetifolia* in shaded hedgerows, 10-20 m; 15.11.2004.

BM 04: Paget Parish: SW end of Elbow Beach, on coastal shrubs (predominantly *Coccocarpia uvifera*), 10-15 m, 32°16.2´N – 64°46.9´W; 3.5.2005.

BM 05: Paget Parish: Elbow Beach, area of "Coco Reef Resort", on *Coccocarpia uvifera, Cocos nucifera, Juniperus bermudiana*, *Zamia* sp., 5-15 m, 32°16.4´N – 64°46.55´W; 20.11.2004, 2.5.-5.5.2005, and 15.8.2009.

BM 06: Paget Parish, "Railway Trail" from Paget to Warwick, 20-40 m, 32°15,95´N – 64°48,3´W to 32°16,4´N –64°47,5´W; 12.11.2004 and 5.5.2005.

BM 07: Paget Parish, hedgerow along "Railroad Trail" at the crossing with South Coast Lane, 32°16´46´´N – 64°46´44´´W; 1.11.2007.

BM 08: Paget Parish, Paget Cemetery, on old tombstones, aeolian limestone wall, or trees, 10-20 m, 32°17´N – 64°46´35´´W; 1.11.2007 and 14.8.2009.

BM 09 Paget Parish: Paget Marsh, on *Rhizophora mangle, Juniperus bermudiana*, *Myrica cerifera,* or *Sabal bermudana*, 0-2 m, 32°17.1´N – 64°46.5´W; 15.11.2004, 3.5.2005, and 12.8.2009.

BM 10: Paget Parish, Paget, South Coast Lane, 40 m, 32°16´ N – 64°47.3´ W; 5.5.2005.

BM 11: Paget Parish, near downtown Hamilton, Bermuda Botanical Gardens, on *Roystonia regalis* or *Ficus* sp., 20 m; 18.11.2004, 7.5.2005, and 5.11.2007.

BM 12: Paget Parish, Harbour Road, house of David Wingate, 10 m, 32°16.3´N – 64°49.15´W; 4.11.2007.

BM 13: Pembroke Parish, Orange Valley Road, 100 m S of Palmetto Road, in secondary forest with *Sabal bermudana* and *Eugenia uniflora*, 5 m, 32°19.23´N – 64°44.4´W; 3.11.2007.

BM 14: Smith´s Parish, SW side of Devonshire Marsh, road bank along Parson Road with limestone outcrops, on *Juniperus bermudiana*, 2 m, 32°18,4´N – 64°45,56´W; 3.11.2007.

BM 15: Smith´s Parish, Sears Cave, grove of *Celtis laevigata* at the mound, 15 m, 32°18.8´N – 64°43´W; 3.11.2007; additional material was collected here by Wolfgang Sterrer in 2008.

BM 16: Smith´s Parish: Spittal Pond, on *Coccocarpia uvifera* or *Casuarina equisetifolia*, 5-10 m; 14.11.2004.

BM 17: Hamilton Parish: Hamilton Island, 200 m S of Abbott's Cliff, dense shrubbery at left along the small road in continuation of Abbott's Cliff Lane, 60 m, 32°16.2´ N – 64°43.8´W; 3.5.2005.

BM 18: Hamilton Parish: Harrington Sound, Abbott's Cliff, dense thicket with poison ivy, 2-10 m, 32°20.43´N – 64°43.5´W; 5.11.2007.

BM 19: Hamilton Parish: Walsingham area, entrance of Admiral's Cave, 3-5 m, 32°21.1´N – 64°42.8´W; 3.11.2007.

BM 20: Hamilton Parish: parking lots at Crystal Cave, 15-20 m, 32°20.57´ N – 64°42,6´W; 11.11.2004.

BM 21: Hamilton Parish: Blue Hole NP, mangrove belt, on *Rhizophora mangle*, *Eugenia uniflora*, or coastal limestone, 5 m, 32°20.4´N – 64°42.56´W; 11.11.2004, 3.5.2005 and 2.11.2007.

BM 22: Hamilton Parish: Blue Hole NP, mouth of Walsingham Cave, foliicolous community on leaves of *Sabal bermudana*, 2-5 m, 32°20.4´N – 64°42.6´W; 4.5.2005 and 3.11.2007; all det. R. Lücking.

BM 23: Hamilton Parish: Walsingham area, in open coastal forest near Walsingham Lake; 8.5.2005 and 14.8.2009. This locality also includes all collections made along the trail at Tom Moore's Tavern, on calcareous outcrops, *Cassine leana, Zanthoxylum flavum* or the trunks of dead *Juniperus bermudiana*, 1-5 m, 32°20.6´ to 32°20.7´N – 64°42.6´W to 64°42.8´W; 2.11.2007 and 14.8.2009.

BM 24: Hamilton Parish: Walsingham area, NW of Walsingham Lake, dense coastal forest with limestone outcrops in permanent shade, cave entrance, 3 m, 32°20.75´N – 64°42.8´W; 2.11.2007.

BM 25: Hamilton Parish: Walsingham area, edge of Walsingham Lake, 0-5 m, 32°20.6´N – 64°42.8´W; 2.11.2007 and 14.8.2009.

BM 26: Hamilton Parish: Walsingham area, Paynter's Hill, on low calcareous outcrops, 50-60 m, 32°20.3´N – 64°42´W; 8.5.2005.

BM 27: St. George´s Parish, Nonsuch Island, 5-10 m, 32°16.2´N – 64°41.9´W; 8.5.2005.

BM 28: Smith´s Parish, Tucker´s Town, Church Cave, on old Bermuda Palmetto stumps, 50 m, 32°20.1´N – 64°42.2´W; 3.11.2007.

BM 29: Smith´s Parish, Tucker´s Town, Mid Ocean Club Golf Course, Mangrove Lake, on *Rhizophora mangle*, 1 m, 32°19.5´N – 64°42.6´W; 3.11.2007.

Other abbreviations and symbols

Chall. Exp. = Specimens collected by H.N. Moseley, the naturalist on board the *H.M.S. Challenger* during its 1873 visit to Bermuda. Locality and substrate information (beyond "Bermuda") is non-existent for almost all of these specimens. These are the earliest specimens of Bermuda lichens; most are housed at BM, but a few are also found in H-NYL. By way of literature and herbarium searches we have accounted for all of these specimens (43 total). As Riddle (1916) did not examine them, this series of papers is the first modern account of these historic specimens.

* = Species new to Bermuda.

+ = New nomenclatural combination.

= Lichenicolous fungus.

= Non-lichenized fungus, resembling a lichen.

RESULTS

Species list

NB: For an explanation of Berger collection site abbreviations, see the Methods section. Berger (Be) specimen numbers < 20000 were collected in 2004; > 20000 in 2005; > 22000 in 2007; and > 23900 in 2009. They are deposited in the first author's private herbarium (hb. Berger), except where indicated in the text. The dates of collection for the LaGreca specimens are given together with the specimen numbers in the text; these specimens are all deposited in BM except where noted. All collection dates are in the European standard (i.e. day/month/year).

****Amandinea efflorescens*** (Müller Arg.) Marbach

BM 05: *Casuarina equisetifolia*, Be 19689. – BM 20: *Sabal bermudana*, *Be 22314*.

Amandinea endachroa (Malme) Marbach

This species was recently reported new to North America by Lücking et al. (2011).

BM 23: decorticated wood of *Juniperus bermudiana*, *Be 23970*.

Amandinea extenuata (Müller Arg.) Marbach

This species replaces the very similar *A. punctata* (Hoffm.) Coppins & Scheidegger of North America and Europe in neotropical habitats. Riddle (1916: 159) reported *Buellia myriocarpa* (DC.) Mudd—a synonym of *A. punctata*—from Tucker´s Town, but the specimen he cites (!NY, *E.G. Britton 867*) is a mix of different species (including *Dirinaria applanata* and *Microphiale lutea*) and needs re-examination.

BM 09: *Juniperus bermudiana, Be 20054*; *Eugenia uniflora*, *Be 19556*; *Rhizophora mangle*, *Be 19575*. – BM 27: *Sabal bermudana*, 5 m, *Be 20053*.

Amandinea leucomela (Imshaug) P. May & Sheard

This is the only *Amandinea* with a UV+ orange thallus (containing lichenoxanthones). Formerly reported only from Jamaica, with all specimens growing on bark (Marbach 2000). Another specimen of this species, collected by R.P. Korf et al., was found in herbarium NY by the junior author. Although it is a Korf collection, there is no duplicate in herbarium CUP.

BM 02: old sandstone tombstone, *Be 22316*. – Paget Parish, Bermuda Botanical Gardens, 18.1.1980, *R.P. Korf et al. AR-BER 30* (!NY; det. H. Imshaug).

Amandinea polyspora (Willey ex Tuck.) E. Lay & P. May

This species, formerly known only from the eastern USA (Brodo et al. 2001; Sheard & May 1997), is a good example of an eastern North American lichen that reaches its eastern-most limit in Bermuda.

BM 04: on *Coccoloba uvifera*, *Be 19550*. – BM 05: on petiole of *Zamia* sp., *Be 19573*.

Amandinea submontana Marbach

BM 26: wooden fence post, *Be 20085*.

Anisomeridium tamarindi (Fée) R.C. Harris

Thallus milky white to vanishing, KOH-, UV-, with *Trentepohlia*; ascomata half to almost fully immersed, sometimes only the clypeate ostiole visible, 300 x 150 µm; paraphysoids slender, <1 µm wide; asci 75 x 9 µm spores 8 per ascus, biserrately arranged, 1-3 septate, 18–22 x 4.5–5 µm.

BM 09: on twigs of *Rhizophora mangle*, 2 m, *Be 19559*. – BM 06: *Melia azederach*, *Be 20196*. – BM 27: *Cassine laneata*, *Be 20022*; on *Sabal bermudana*, *Be 20023*; all det. A. Aptroot.

Arthonia antillarum (Fée) Nyl.

This is a rather common and conspicuous species on well-lit, smooth bark of various trees, in small patches between other *Arthonia* spp. such as *A. polymorpha*. This species was recently reported new to North American by Lücking et al. (2011).

BM 01: *Cocos nucifera*, *Be 22338*. – BM 05: *Cocos nucifera*, *Be 20025*; *Eugenia uniflora*, *Be 22325*, *22420*. – BM 09: dead leaf base of *Sabal bermudana*, 2 m, *Be 20049*. – BM 15: *Celtis laevigata*, *Be 22355*, *22778*, *22783*.

Arthonia parantillarum Aptroot

BM 15: *Celtis laevigata*, *Be 22355*, *22779* (leg. W. Sterrer).

Arthopyrenia cinchonae (Ach.) Müller Arg.

BM 06: shaded hedgerow, *Be 19626*; det. A. Aptroot. – BM 18: *Be 22331*.

Arthopyrenia gregale R.C. Harris

BM 23: on shaded limestone, *Be 24054*.

Arthopyrenia minor R.C. Harris

BM 08: *Sabal bermudana*, *Be 22329*. – BM 18: *Juniperus bermudiana*, *Be 22332*. – BM 23: *Juniperus bermudiana*, *Be 22333*.

Bacidia arceutina (Ach.) Arnold

BM 05: on *Juniperus bermudiana* in shade, *Be 19563*. – BM 06: shaded hedgerow, 40 m, *Be 19568*.

Bacidia circumspecta (Nyl. ex Vainio) Malme

BM 09: on *Sabal bermudana*, *Be 20156*.

Bacidia friesiana (Hepp) Körb.

BM 05: trunk of *Cocos nucifera*, *Be 20157*.

Bacidia cf. ***subcircumspecta*** Coppins

The specimens cited here are similar in most respects to *Bacidia subcircumspecta* except for the saxicolous habit. This lichen was previously known only from Scotland (Smith et al. 2009). This species is rather frequent on hard and soft limestone.

The holotype specimen of *Lecidea semiusta* Stirton (!BM, *ex* K, BM barcode no. BM000764625; the same specimen as the isotype of *Verrucaria ruderella* Nyl.) appears to be a non-fertile specimen of *B.* cf. *subcircumspecta*, and this is verified by the spore measurements given in Stirton (1874). As noted by Stirton (q.v.) and Riddle (1916), the one apothecium used to make these spore measurements was destroyed, and no others are present. Although *Lecidea semiusta* has priority over *Bacidia subcircumspecta*, we do not wish to formally synonymize the latter name with the former because there are no other apothecia to confirm it.

BM 23: on limestone, 8 m, *Be 20119*. – BM 10: on mortar, *Be 20104*; det. B.J. Coppins. – Hamilton Parish, Walsingham, edge of Tucker's Town golf course, on limestone, 50 m, 32°20.3´N – 64°42.1´W, 8.5.2005, *Be 20178*. – BM 08: aeolian limestone, *Be 22477*. – Paget Parish, Berry Hill Road, top of aeolian limestone wall, 10 m, 5.11.2008, *Be 22479*. – St George's Parish, south side of Ferry Road, between Mullet Bay Road and the Royal/Dutch Shell Companies, on stone staircase, 10.8.2006, *LaGreca 2185*; det. B.J. Coppins.

Bacidia subturgidula (Nyl.) Zahlbr.

These specimens agree very well with the holotype in BM, differing only by their sessile (rather than immersed) pycnidia and their 1-septate (rather than simple) conidia, 7–9 x 1–1.4 µm. This species was formerly considered endemic to Britain (Smith et al. 2009). These are the first known records outside the type locality in New Forest, England.

BM 17: wood of *Juniperus bermudiana*, 60 m, *Be 20108*; det. B.J. Coppins. – BM 27: *Sabal bermudana*, 5 m, *Be 20111*; det. B.J. Coppins. – BM 23: decorticated *Juniperus bermudiana*, *Be 22484*.

+*Bacidina brittoniana* (Riddle) LaGreca & Ekman **comb. nov.**
MycoBank no. MB808754
= *Bilimbia brittoniana* Riddle, Bull. Torr. Bot. Club 43: 152. 1916.
= *Bacidina varia* Ekman, Opera Botanica 127: 124. 1996.

Typus. North shore, on exfoliating bark of *Juniperus bermudiana*, September 1905, *E.G. Britton 77* (!FH, FH barcode no. 00079910–holotypus; !NY—isotypus). No secondary compounds by TLC (holotype tested).

Applying Ekman's (1996) excellent key to some granulose, Bermudian bacidioid specimens collected by the first author, we concluded that they were in fact *Bacidina varia*, a species described from the southeastern United States. A subsequent comparison of the types of *Bilimbia brittoniana* with these specimens (and to the type description of *Bacidina varia*) suggested that the name *Bilimbia brittoniana* actually has priority over *Bacidina varia*. Stefan Ekman kindly examined the holotype of *Bilimbia brittoniana* and confirmed this.

Therefore, *Bacidina varia* is hereby formally synonymized with *Bilimbia brittoniana*. Further, we must recombine this latter name into *Bacidina*. As it is now known from the southeastern United States, this taxon can no longer be considered endemic to Bermuda.

Additional specimens examined. – BERMUDA: BM 06: shaded hedgerow, Be *19565*, *19568*, *19569*, *19614*, *19571*. – Warwick Parish, Railway Trail, on *Ficus* sp., 05.05.2005, *Be 20039*. – BM 23: *Eugenia uniflora*, *Be 22342*. – BM 17: *Be 22343*. – U.S.A.: FLORIDA: Sanford, 1914, *Rapp s.n.* (!FH).

Bacidina pallidocarnea (Müller Arg.) Vězda

All foliicolous lichens in this paper were found together at this one location in Walsingham. This particular species is pantropical in distribution.

BM 22: on leaves of *Sabal bermudana* in a constantly shaded sinkhole, 3 m, *Be 20012*; det. R. Lücking.

Bactrospora denticulata (Vain.) Egea & Torrente

BM 14: *Be 22351*. – BM 23: *Be 22352*. Both specimens were collected on decorticated trunks of *Juniperus bermudiana*.

Bactrospora myriadea (Fée) Egea & Torrente

BM 08: *Sabal bermudana*, *Be 22350*. - BM 09: stilt roots of *Rhizophora mangle*, *Be 19572*, *19590*, *20199*; dead leaves of *Sabal bermudana, Be 20049*, *23980*, 23981. – BM 23: *Eugenia uniflora*, *Be 23984*; *Juniperus bermudiana*, *Be 22353* (= same specimen as isotype of *B. flavopruinosa*; ABL, LI, hb. Berger; Berger & Aptroot 2008).

Baculifera micromera (Vain.) Marbach

This specimen was found in small patches between other crustose species on smooth, well-lit bark. This is a distinctive taxon close to *Hafellia disciformis*, but with a conspicuous KOH+ emerald green reaction of the greenish black epihymenium; in addition, the hymenium not inspersed with oil droplets. *Baculifera micromera* has been collected previously from Brazil, Guatemala and Kenya, but the specimen cited below is probably the northernmost collection of this species. Interestingly, our Bermudian specimen is anatomically closer to the African than to the neotropical material (compared with material of hb. Kalb, some of which was cited in Marbach 2000). While its appearance under the stereomicroscope is very similar to specimens *Kalb 13246*, or *Kalb 28957*, there are microscopic differences: the latter specimens differ in exhibiting a very weak KOH+ olive reaction of the epihymenium, and possess a more compact excipulum tissue. Bermudian *B. micromera* in contrast has a well-developed, honeycomb-like, paraplectenchymatous excipulum with round cells, c. 5-11 µm each in diameter. Spores of all specimens are consistently 17.5-18.5 x 5.5-6.5 µm, smoky brown, 1-septate, apically with a discrete, thickened endoascus with conspicuous refractive poles, and no ornamentation at any age. Chemistry: atranorin (TLC by F. Schumm).

BM 15: *Celtis laevigata*, *Be 22796* (leg. W. Sterrer).

Bagliettoa baldensis (A. Massal.) Vězda

Rather frequent, especially in the cut-throughs of the old railway. One of the most shade-tolerant Bermudian lichens, it is often found in gaps between mosses. Our specimens match the description of Halda (2003) exactly.

BM 08: on aeolian limestone wall, *Be 22490*, *24048*, *24051*. – BM 19: on mortar, *Be 20050*. – BM 23: on shaded limestone, *Be 20051*; det. O. Breuss.

Botryolepraria lesdainii (Hue) Canals, et al.

This lichen is a frequent colonizer of shady, mossy, aeolian limestone, predominantly on vertical, north-facing rocks in brushy woods.

Paget Parish, Railway Trail, shaded limestone overhang, 25 m, *Be 20105*.

Byssoloma chlorinum (Vain.) Zahlbr.

This is a rare, pantropical foliicolous lichen (Lücking 1992).

BM 22: on leaves of palmetto, together with *Bacidina pallidocarnea*, *Be 20013*, *20014*; both det. R. Lücking.

Byssoloma leucoblepharum (Nyl.) Vainio

A special association of inconspicuous, crustose lichens can be found on the very bottom parts of thin stilt roots of *Rhizophora* in Bermuda´s inland swamps. This is only possible because no tidal changes in water level, and no waves, touch this habitat. Members of this association include *Byssoloma leucoblepharum*, *B. subdiscordans, Lecidea* sp., and *Enterographa*. The last two species in this list grow exclusively on this substrate in Bermuda.

BM 09: basal parts of stilt roots of *Rhizophora mangle*, *Be 20055*, *23993*. – BM 22: leaves of *Sabal bermudana*, *Be 20011*; conf. R. Lücking. – BM 23: at eye-level on smooth, shady bark of *Eugenia monticola*, *Be 22354*.

Byssoloma subdiscordans (Nyl.) P. James

BM 09: base of stilt roots of *Rhizophora mangle*, *Be 20010*, *20033*.

Caloplaca dichroa Arup

BM 02: on limestone tombstone, *Be 22359*; det. J. Vondrak.

Caloplaca epiphora (Tayl.) Dodge

BM 02: saxicolous on a tombstone, *Be 22360*. – BM 16: *Casuarina equisetifolia*, *Be 19579*. – BM 20: *Leucaena* sp., *Be 19588*, *19686*. – BM 21: *Rhizophora mangle*, *Be 19596*. – BM 29: *Rhizophora mangle*, *Be 22362*.

Caloplaca flavorubescens (Hudson) J.R. Laundon

This species is known from Eastern North America; the Berger specimen cited here matches the photograph in Brodo et al. (2001) exactly. It differs from European material by its greyish thallus and the rather different ecology.

Another specimen of this species, collected by R.P. Korf et al., was found in herbarium NY by the junior author, filed in a cardboard box of neotropical "*Caloplaca* indet" specimens at the beginning of the genus. Like the Berger specimen, it was collected from *Rhizophora mangle*; unlike the Berger specimen, it has no thallus. It has bright orange apothecia with yellow rims, and in all respects keys confidently to *C. flavorubescens*. Although it is a Korf collection, there is no duplicate in herbarium CUP.

BM12, stem of *Rhizophora mangle*, 1 m, *Be 22362* – Hamilton Parish, North Nature Preserve, near Mangrove Lake, on trunk of *Rhizophora mangle*, 21.1.1980, *Korf et al. AR-BER 144* (!NY).

Caloplaca floridana (Tuck.) Tucker

This species was listed in Riddle (1916: 159) as *Blastenia floridana* (Tuck.) Zahlbr.

BM 02: sandstone, *Be 22361*, *22396*. – BM 03: corticolous in shaded hedgerow, *Be 19607*. – BM 09: on *Rhizophora mangle*, with *Bacidina brittoniana*, *Be 20128*; on *Rhizophora mangle*, with

Hyperphyscia adglutinata and *Lecanora caesiorubella* (this last species is not treated in the current paper), *Be 19610*. – Paget Parish, Paget, bus station at the supermarket, on lacquer on concrete wall, 20 m, 5.5.2005*, Be 20057*, *20058*. Biological Station, on tamarisk, August 31-September 20,1905, *E.G. Britton 36* (!FH, !NY); det. C. Wetmore (Wetmore 1994). – North of Hamilton, on *Coccoloba uvifera*, August 31-September 20, 1905, *E.G. Britton 66* (!FH, !NY); det. C. Wetmore (Wetmore 1994).

Caloplaca holocarpa (Hoffm.) A. E. Wade.

This is a very common pioneer species on artificial calcareous surfaces, found more rarely on roadside limestone outcrops. Frequently observed on low, aeolian limestone walls along sidewalks.

St George's Parish, Town of St George, bus station adjacent to Godet & Young's Hardware Store on Wellington Street, on limestone wall, 10.8.2006, *LaGreca 2186*; det. P.W. James. – Paget Parish, Paget, bus station at the supermarket, on laquer on concrete wall, 20 m, 5.5.2005, *Be 20057*. – BM 02: *Be 22395*.

Caloplaca sarcopisoides (Körb.) Zahlbr.

The shape and size of the spores, as well as the KOH- reaction of the thallus and all parts of the apothecia, are the same in both *Caloplaca obscurella* and *C. sarcopisioides.* However, Bermudian material of the latter species differs from *C. obscurella* in having an invisible (= non-epiphloedal) thallus and in possessing lirelliform, green, convex soralia. Thus, the soralia are lacking a distinct, thalline border, which normally results from the rupture of flat vesicles, whereby the soralia are generated. In addition to these thallus differences, *C. obscurella* rarely has shiny apothecia with margins concolorous with the disks. Also, the excipulum is composed of paraplectenchymatous, pachydermous cells up to 9 µm in diameter. The tips of the paraphyses also differ between the two species. In *C. obscurella*, the tips are furcate, with club-shaped ends bearing a brown-coloured, pellucid cap that reaches halfway down the tip. In *C. sarcopisoides*, by comparison, the tips display a remarkable broom-like ramification with a brown, gelatinous, wrinkled sheet.

Bermudian specimens of *C. sarcopisoides* also differ in the structure of their proper exciple: it is narrow (<9 µm in diameter) and composed of periclinally arranged hyphae, and the excipulum thallinum contains scattered *Trebouxia* algae. In contrast, European specimens have entangled hyphae with a textura paraplectenchymatica that is clearly visible in thin cross-sections.

The ecologies of the two species also differ: *Caloplaca obscurella* occurs on shaded tree bases, and sometimes decorticated wood in temperate areas, whereas *C. sarcopisoides* occurs on sun-exposed barks in the subtropics.

The thallus of Bermudian specimens of *C. sarcopisoides* growing on the soft, cork-like, uneven bark of palms (*Sabal bermudana* and *Roystonia regalis*) is a thin, milky homogenous stain on the substrate, spotted with minute, sometimes confluent, lirelliform, dark serpentine-green soralia. This species also occurs on lignum of *Juniperus*, where it also displays a very thin, milky-white thallus, but differs from specimens on rotten wood in bearing scattered, white, roundish soralia. We should note here that, unlike European specimens of *C. sarcopisoides*, all Bermudian specimens are sorediate. The soralia are raised, 0.1-0.2 mm in diameter, and partly delimited by a white thalline rim; the soredia are farinose, with some short, thorn-like projections. We did not observe the grey, crustose thalli typical of European *C. obscurella*, which look "punched" due to their conspicuous, erosive soralia with white thalline margins. The tubular, lobe-like thallus sections containing small, punctiform ("needle-punched") soralia, sometimes evident in Mediterranean specimens of *C. obscurella*, were also not observed.

The comparison of material with *C. sarcopisoides* showed variability in thallus morphology between European specimens as well, and this variation seems to be correlated with ecology and substrate; but we leave the taxonomy of this group for future workers.

BM 17: *Melia azederach*, *Be 20060*. – City of Hamilton, Bermuda Botanical Gardens, on trunk of *Roystonia regalis*, 40 m, 7.5.2005, *Be 20061*. – BM 07: *Sabal bermudana, Be 22356*. – BM 14: on decorticated *Juniperus bermudiana*, *Be 22358*.

Key to* Caloplaca *species of Bermuda

1. Thallus or apothecia at least in parts orange or yellow 2
1´. Thallus or apothecia without an orange/yellow color 5
2. Thallus without apothecia; granular or isidiate 3
2´. Apothecia always present 4
3. Thallus a felt of dense yellow or orange-yellow granular isidia in a greyish-green prothallus ..... *C. epiphora*
3´. Thallus consisting of orange, +/- loose granules, no prothallus; on sandstone only ..... *C. dichroa*
4. Apothecia vivid orange, up to 1.2 mm diam., on bark, with a distinctly bright yellow margin ..... *C. flavorubescens* s.l.
4´. Apothecia orange, < 0.3 mm, frequent on calcareous (including artificial) substrates ..... *C. holocarpa*
5. Apothecia dark grey, margin more bright, epihymenium KOH+ purple ..... *C. floridana*
5´. Apothecia shiny pinkish-brown to dark brown, on lignum of *Juniperus* or soft bark, all parts KOH-; thallus inconspicuous, but always with soralia ..... *C. sarcopisioides*

Canoparmelia martinicana (Nyl.) Elix & Hale

This species was one of three Bermudian lichen species treated by Hale (1986).

BM 08, on palm trunk, *Be 24017*; det. H. Sipman. – BERMUDA: [Exact location unknown], on "Pride of India" tree [*Melia azedarach*], 1916, *Hervey [?] s.n.* (!US, *ex* Hb. C.C. Plitt, *ex* Hb. G.K. Merrill); det. M.E. Hale (not signed by him, but his handwriting is unmistakable).

****Catillaria modesta*** (Müller Arg.) Coppins

On shaded, low, limestone outcrops in Walsingham forest. This species was recently reported as new to North American by Lücking et al. (2011).

BM 08: *Be 24048*. – BM 23: *Be 22471*, *23991*, *24055*, *24056*.

****Celothelium aciculiferum*** (Nyl.) Vainio

This weakly lichenized ascomycete, originally known from Central and South America (Aguirre-Hudson 1991), has since been reported from Florida, USA (Harris 1995, Lücking et al. 2011).

BM 09: *Rhizophora mangle*, 2 m, *Be 20029*; det. A. Aptroot.

****Clathroporina isidiifera*** R.C. Harris

This is a frequent species in Bermuda, found on smooth bark of various tree species in the dappled shade of hedgerows and forests. Our material of *Clathroporina isidiifera* is luxuriantly isidiiferous. *Clathroporina tetracerae* (Ach.) R.C. Harris was reported by Riddle (1916: 147); the specimen cited by Riddle (!FH, *E.G. Britton 293*; the duplicate in NY has not yet been examined by us) has ascocarp and spore anatomy identical to *C. isidiifera*, but lacks isidia. Sérusiaux et al. (2007) pointed out that isidia are of no significant value for species determination in this family, and further, that the abundance of isidia is negatively correlated to the development of ascocarps. *Clathroporina isidiifera* should probably, therefore, be synonymized with *Clathroporina tetracerae*. We do not do this formally here—we leave the solution of this problem to future workers.

BM 03: on *Eugenia uniflora* in shaded hedgerow, *Be 19653*. – BM 04: *Eugenia uniflora*, *Be 20147*. – BM 09: on stilt roots of *Rhizophora mangle*, *Be 19652*, *20064*, *20142* (with *Porina*

atlantica). – BM 22: *Eugenia uniflora*, *Be 20065*. – BM 23: *Eugenia uniflora*, *Be 19653*, *22366*. – Hamilton Parish, Walsingham, on coffee trees, *E.G. Britton 293* (!FH).

Clauzadea metzleri (Körb.) Clauzade & Cl. Roux ex D. Hawksw.

Only a few Bermudian lichens are able to colonize the soft surface of aeolian limestone. This one prefers shaded locations in the forest understory, but it is also sometimes found on naked cliffs in full sun. Besides Europe, it is also known from Puerto Rico, the Dominican Republic and the USA.

Apothecia dark brown to black, closely adpressed to the substrate; spores ovoid, 16-18 x 8-9 µm.

BM 02: *Be 22399*. – BM 05: on SE-facing aeolian limestone in the supralittoral zone, *Be 24064*. – BM 08: top of old aeolian limestone wall, *Be 22397*, *22398*, *22470*. – BM 09: on mortar, *Be 20103*. – BM 14: low aeolian limestone outcrop along NW edge of Devonshire Marsh, *Be 22400*. – BM 27: vertical S-facing cliff, *Be 20102*. – Hamilton Parish, Harrington Sound, Rabbit Island, south cliff, 5.11.2007, *Be 22398*.

Coccocarpia palmicola (Sprengel) Arvids. & Galloway

A very rare species, only collected once.

BM 21: stem of *Rhizophora mangle*, *Be 19581*.

Coenogonium interplexum Nyl.

More species of Bermudian *Coenogonium* sp. should be treated in a forthcoming paper.

BM 09: on basal parts of stilt roots of *Rhizophora mangle*, with *Cryptothecia striata,* 2 m, *Be 20069*, *23987*.

Collema furfuraceum (Arnold) Du Rietz.

Collema furfuraceum differs from C. *pulcellum* Ach. var. *subnigrescens* (Mull. Arg.) Degel. (a Bermudian species reported in Degelius 1974; it will be treated in a future publication in this series) mainly by the dense, globular isidia along the thallus ridges.

BM 17: corticolous, *Be 20067*. – BM 21: *Rhizophora mangle*, *Be 19582*, *20066*. – BM 25: *Rhizophora mangle*, *Be 22366*.

Collemopsidium sublitorale (Leight.) Grube & B.D. Ryan.

This is a rare element of Bermuda's nearly non-existent supralittoral lichen flora.

St. George´s Parish, St. George's Island, Whalebone Bay, on aeolian limestone, 2 m, 12.8.2009, Be *24065*, *24066*.

Cratiria lauricassiae (Fée) Marbach

This species seems to be very rare in Bermuda; it was only collected once.

BM 09: on *Rhizophora mangle*, 3 m, *Be 19576*.

Crypothecia striata Thor

By far the most common substrate for this species are limestone overhangs in the Walsingham area. It occurs there with *Petractis farlowii* and *Opegrapha* sp. We also found one corticolous specimen in Paget Marsh. All specimens listed by Riddle (1916: 151) as *Chiodecton montagnei* Tuck. are *Cryptothecia striata* (Thor 1991).

BM 09: *Rhizophora mangle*, with *Coenogonium interplexum*, 2 m, *Be 19583*, 20070. – BM 23: on rain-protected overhangs of crystalline limestone, *Be 20073*; det. L. Sparrius. – BM 24: n.c.

Diploicia canescens (Dicks.) A. Massal.

This lichen occurs frequently on older, artificial, calcareous surfaces such as walls and tombstones. It can also be found on natural, calcareous rock outcrops. Riddle (1916: 158-159) suggested that this lichen was first introduced to Bermuda by early settlers. The first continental North American record was published much later, by Bratt (1984).

BM 02: on sandstone, *Be 22458*. – BM 08: on whitewashed mortar, n.c. - BM 10: on mortar, *Be 20104*, *20160* (*Be 20160* verified by TLC).

Dirinaria applanata (Fée) Awashti

Reported by Riddle (1916) under various synonyms.

BM 05: *Coccoloba uvifera*, *Be 20154*; *Melia azedarach*, *Be 20158*. – BM 09: *Sabal bermudana*, *Be 20156*. – BM 08: on granite tombstone, *Be 22374*. – BM 02: on granite tombstone, n.c.

****Dirinaria confusa*** Awashti

This is the most rare of the three *Dirinaria* species known from Bermuda. [The third is *D. picta*, listed by Riddle (1916: 160) as *Physcia picta* (Sw.) Nyl.]

BM 05: *Juniperus bermudiana*, 15 m, *Be 19606*.

****Endocarpon petrolepideum*** (Nyl.) Hasse

BM 08: on top of aeolian limestone wall beneath shrubs, with *Stromatella bermudana*, *Verrucaria anceps* and *V. baldensis*, 15 m, *Be 22481*, *22487*, *24052*; all det. O. Breuss.

****Enterographa anguinella*** (Nyl.) Redinger

Found on well-lit bark of various tree species.

BM 05: *Coccoloba uvifera*, *Be 19635*. – BM 09: *Rhizophora mangle*, *Be 20074*. – BM 21: trunks of *Rhizophora mangle*, *Be 20028*, *20098, 20198*; on *Nerium oleander*: *Be 20044*. All conf. L. Sparrius.

****Enterographa multilocularis*** (Müller Arg.) Sparrius

Thus far, found only on the basal parts of stilt roots of *Rhizophora mangle* (see remark under *Byssoloma leucoblepharum*). This species is not on the North American lichen checklist (Esslinger 2014).

BM 09: on stilt roots of *Rhizophora mangle*, *Be 20075*, *20076*, *20173*.

****Enterographa pallidella*** (Nyl.) Redinger

This inconspicuous species is difficult to detect, even with a stereomicroscope. Specimens from neotropical locations are known from Florida (Seavey & Seavey 2012), Belize, Costa Rica and Hawaii (Sparrius 2004). The specimen cited below is the northern-most collection of this species to date.

BM 09: on dead leaf blade of *Sabal bermudana*, *Be 20049*; det. L. Sparrius.

****Graphis*** cf. ***apertella*** Archer

We have followed Lücking (2009) with regards to species delimitation in *Graphis*. *Graphis apertella* differs from *G. lineola* only in the presence of norstictic acid and in possessing a dirty-brownish epihymenium.

BM 09: on well-lit parts of *Rhizophora mangle*, *Be 19682*, *20092*.

****Graphis hossei*** Vain.

BM 09: on well-lit parts of *Rhizophora mangle*, *Be 19591*.

Graphis pinicola Zahlbr.

This species has recently been reported as new to North America by Lendemer (2010).

BM 09: on *Rhizophora mangle*, *Be 20127*.

****Graphis leptoclada*** Müller Arg.

BM 21: *Rhizophora mangle*, 5 m, *Be 19592*.

****Hafellia bahiana*** (Malme) Sheard

On sun-exposed, smooth bark—predominantly coastal *Coccoloba uvifera*. This species is a characteristic member of a colourful, crustose lichen association in this habitat that includes *Pertusaria xanthodes*, *P. heterochroa*, *Pyrenula concatervans*, *P. cocoes* and *Caloplaca epiphora*.

BM 03, shaded hedgerow, *Be 19601*. – BM 04: *Coccoloba uvifera*, *Be 20020*, *20048*. – BM 05: *Coccoloba uvifera*, *Be 19602*. – BM 21: *Coccoloba uvifera*, *Be 19600*, *19667*; *Rhizophora mangle*, *Be 20086*. – BM 23: *Eugenia uniflora, Be 22315*, *23984*.

Hafellia disciformis (Fr.) Marbach & H. Mayrhofer

This species was listed by Riddle (1916: 159) under a synonym, *Buellia parasema* De Not; a re-examination of the specimens cited by Riddle is currently underway.

BM 02: on sandstone, *Be 22313*. – BM 15: *Celtis laevigata*, *Be 22340*. – BM 23: *Be 22315*.

Heterodermia albicans (Pers.) Swinsc. & Krog

This is by far the most common species of *Heterodermia* in Bermuda.

Paget Parish, Railway Trail, E South Coast Lane, on concrete, 30 m, 5.5.2005, *Be 20088*. – BM 08: on granite, *Be 22387*; on palm trunk, *Be 24002*. – BM 11: corticolous, *Be 19603*. – BM 09: *Rhizophora mangle*, 2 m, *Be 19604*, *20070*, *20092*, all det. R. Moberg; decorticated twig of *Juniperus*, *Be 24003*. – BM 17: *Juniperus bermudiana*, *Be 20140*. – BM 20: *Leucaena* sp., *Be 19605*.

Heterodermia obscurata (Nyl.) Trev.

BM 20: *Leucaena* sp., 20 m, *Be 19609*.

Heterodermia pseudospeciosa (Kurak.) W.L. Culb.

BM 09: *Myrica cerifera,* 3 m, *Be 20133*. – BM 17: *Juniperus bermudiana*, *Be 20089*.

Hyperphyscia adglutinata (Flörke) Mayrh. & Poelt

Frequent in *Physcia*-, *Dirinaria*- and *Heterodermia*-dominated lichen communities (e.g. on well-lit basal trunks of palms and other trees).

BM 02: *Cocos nucifera*, *Be 22389*. – BM 03: in shaded hedgerow, *Be 19607*, 19587. – BM 05: *Cocos nucifera*, *Be 20094* (det. R. Moberg), *20095*; *Juniperus bermudiana*, *Be 19608*; *Eugenia uniflora*, *Be 20096*; *Melia azedarach*, *Be 20158*; on unidentified bark, *Be 20093*. – BM 08: *Araucaria* sp., *Be 22388*. – BM 09: *Rhizophora mangle*, *Be 19611*. – BM 16: in shaded hedgerow, *Be 19609*. – BM 20: *Leucaena* sp., 20 m, *Be 19588*.

Hyperphyscia minor (Feé) D. D. Awasthi.

BM 03: on bark of a bush, *Be 19586*. – No specific locality, on palm bark, 7.1.1916, *A.B. Hervey s.n.* (!NY, Hervey backlog; det. R.C. Harris).

****Ionaspis tropica*** Aptroot

This is a nearly invisible species on calcareous rocks in coastal Bermudian rainforests. Wet conditions greatly increase the visibility of the greyish-pink apothecia sitting in shallow pits. When wet, these disks are the same height as the surface of the substrate.

BM 19: *Be 22390*. – BM 23: on hard, shaded limestone under dense shrubs, with *Strigula bermudana* and *Lithothelium bermudense* (Berger et al., in prep.), *Be 22391*; with *Petractis farlowii*, *Be 24068*.

***##*Julella geminella** (Nyl.) R.C. Harris

BM 04: *Coccoloba uvifera*, *Be 19651, 20113*. – BM 21, *Be 20112*.

***##*Julella lactea** (A. Massal.) M.E. Barr

The spores of this species are hyaline, muriform, 40 x 15 µm, and 1 per ascus.

BM 21: *Be 20114*; det. A. Aptroot.

***Lecanora helva** Stizenb.

BM 04: *Coccoloba uvifera*, *Be 19612*. – BM 05: *Cocos nucifera*, *Be 20025*. – BM 15: *Celtis laevigata*, *Be 23240*. – BM 17: *Be 20018*.

***Lecanora leprosa** Fée

BM 03: *Casuarina equisetifolia*, *Be 19615*. – BM 04: *Coccoloba uvifera*, *Be 20078*. – BM 09: *Rhizophora mangle*, *Be 19682*. – BM 17: *Coccoloba uvifera*, *Be 20144*.

***Leiorreuma sericeum** (Eschw.) Staiger

The trunks of old Bermuda olivewood (*Cassine laneana*), one of Bermuda's endemic tree species, play host to a distinct lichen flora including this species, further *Sclerophyton elegans, Pyrenula acutalis*, and *Anisomeridium tamarindi*.

BM 23: *Cassine laneana*, *Be 20131*.

***Leptogium austroamericanum** (Malme) C.W. Dodge

This cyanolichen is mostly restricted to sheltered parts of the supralittoral zone near Blue Hole, growing with *Lempholemma lingulatum* on hard limestone under buttonwood (*Conocarpus erectus*). Per Magnus Jørgensen, who examined our Bermudian material, remarked on the "unusual form" of our specimens.

Hamilton Parish, Walsingham, on low coastal rocks at Harrington Sound 50 m NW of Blue Hole, 2.11.2007, *Be 22403*, *22404*. – BM 20: *Leucaena* sp., 15 m, *Be 19620*.

***Leptogium** aff. ***corticola** (Taylor) Tuck.

Be 20107 is atypical of this species as it has only very sparse pustules.

BM 07, *Casuarina equisetifolia*, *Be 19619*. – BM 17: *Juniperus bermudiana*, *Be 20107*.

***Leptogium tenuissimum** (Dicks.) Körb.

First reported by Riddle (1916: 156) from Paynter´s Vale, on the ground (specimen not found at NY).

BM 05: on base of trunk of *Cocos nucifera*, *Be 24008*.

***#Lichenodiplis fallaciosa** (Hafellner & Kalb) Diederich

The often-times virtually undetectable conidiomata (even under the stereomicroscope) of this lichenicolous fungus grow in the hymenia of corticolous *Buellia* s.l. It should be noted here that the measurements of the conidia differ [(2.5-3 (–3,5) x 4.2-5.5 (–7)] from those given in Diederich (2003): 3-4 x 6-8 µm. The condiogenous cells are hyaline to slightly brown, 1.5-1.8 (–2) x 5-6 µm. The conidiomata, which are fully immersed in the hymenium of the host, measure 50 x 75 µm,.

Conidiomata of *L. fallaciosa* were encountered side-by-side with ascomata of *Muellerella thalamita* in the hymenium of the same host (*Be 19680, 22791*).

BM 20: in the apothecia of *Orcularia insperata*, *Acacia* sp., *Be 19680*. – BM 15: in the apothecia of *Orcularia insperata*, on twigs of *Celtis laevigata, Be 22791*.

Malmidea vinosa (Eschw.) Kalb, Rivas Platas & Lumbsch

= *Malcolmiella vinosa* (Eschw.) Kalb & Lücking in Lücking & Kalb, Bot. Jb. 122(1): 43.
= *Lecidea caliginosa* Stirton, in Stirton, Jour. Linn. Soc., Bot. 14: 370.

Chall. Exp., !BM (possible duplicate in NYL-H), *ex* K, BM barcode no. BM000764731; det. A. Aptroot. This specimen is the type of *Lecidea caliginosa*. It is erroneously cited as *Biatora fuscorubescens* (Nyl.) Riddle comb. nov. by Riddle (1916: 152).

Malmidea vinosa was recently reported as new to North America by Lücking et al. (2011).

+#***Muellerella thalamita*** (Nyl.) D. Hawksw. , F. Berger & LaGreca **comb. nov.** Figs. 2 & 3
MycoBank no. MB808753
= *Endococcus thalamita* Nyl., in Crombie, Journ. Linn. Soc., Bot. 16: 217. 1877.

Description. *Perithecia* black (nearly invisible on the dark disks of *Orcularia*), immersed (or neary immersed) in the hymenia of the host lichen, 35–[100]–125 µm wide, 50–[75]–120 µm high, ostioles c. 0.1 mm in diam; *textura angularis* in section consisting of 3-4 layers (10 x 3 µm), thicker around the ostiole, with homogenous cells that are elongated throughout the wall; *excipulum* golden brown in the basal circumference, dark brown at the thickened and protruding ostiolum; *hamathecium* with no interascal filaments, but with distinct, very thin periphyses, 25-30 µm long. *Asci* fissitunicate, ovoid,10-25 x 30-50 um. *Ascospores* light grey-brown, thin-walled, ellipsoid, 1-septate, with a dark septum, many per ascus, 2–[3]–4 x 5– [7.5]–10 um.

Typus. "Bermuda insula". Parasitic on apothecia of *Orcularia insperata* (Nyl.) Kalb & Giralt (called "*Lecidea myriocarpa*" by Nylander in the protologue), in association with *Pertusaria pustulata* (Ach.) Duby (called "*Pertusaria melaleuca*" in Crombie 1877), *Chall. Exp.*, !H, *H-NYL 3744* (no duplicate in BM). The number "H 29:18" is handwritten, both in and on the packet.

Distribution and ecology. Parasitic on apothecia of *Orcularia insperata*, *Baculifera micromera* and *Hafellia disciformis* growing on bark. The fungus seems to colonize the host's apothecia at an early stage of development, and often destroys the apothecia.

Remarks. Originally described by Nylander (in Crombie 1877), but for some reason not considered in Riddle (1916). Examination of the tiny specimen present in H-NYL necessitates the transfer of this species to the genus *Muellerella* on the basis of its multispored asci and brown, 1-septate spores (Hawksworth 1979). Examination of fresh material collected during our recent survey work confirmed this new combination, and allowed expansion of our species description.

As noted above, no isotype of *Muellerella thalamita* exists in BM. Examination of a BM specimen (*Pertusaria pustulata*, BM Barcode BM000764751, with some *Orcularia insperata* also on it), which appears to have once been part of the *H-NYL 3744* specimen, failed to turn up additional material of this lichenicolous fungus.

Keissler (1930) listed this species name as a synonym of what we now call *Muellerella pygmaea* (Körb.) D. Hawksw. However, the host lichens and habitat are quite different from those of the latter species (which is obligate on lichens growing on rocks in temperate latitudes). In addition, *M. thalamita* is much closer to *M. lichenicola* in spore shape, colour, and width while having much smaller perithecia than either *M. lichenicola* or *M. pygmaea*. In addition, the perithecial walls of the latter are dark brown, and its hymenial reaction is distinct in Lugol's. Therefore, we recognize it here as a distinct species for the time being.

The co-occurrence of *Lichenodiplis fallaciosa* with *M. thalamita* in the same hymenia of some of our fresh collections merits further attention—perhaps the former is an anamorph of the latter?

Additional specimens examined. – BM 15: on *Hafellia disciformis* growing on *Celtis laevigata*, *Be 22323, 22791*. BM 20: with *Lichenodiplis fallaciosa* on *Buellia s.l.* growing on *Acacia* sp., *Be 19680*. – Paget Parish: Elbow Beach, area of "Coco Reef Resort", on *Baculifera micromera* on *Cocos nucifera*, 15 m, 32°16.4´N – 64°46.55´W; 15.8.2009, *Be 24041*.

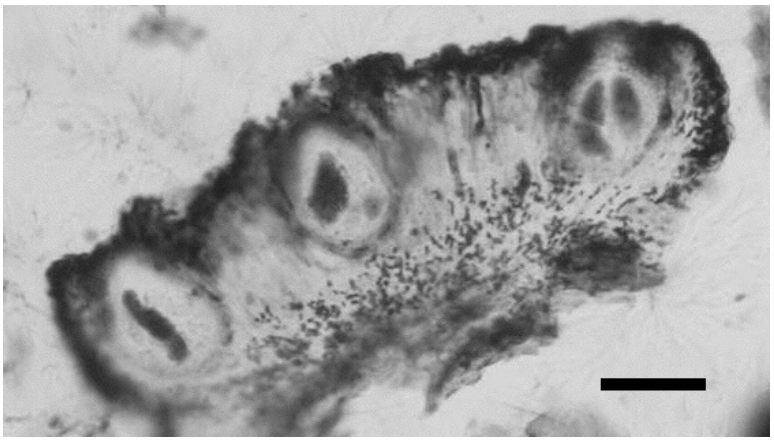

Figure 2. *Muellerella thalamita* (*H-NYL 3744*), vertical section of *Orcularia insperata* with three perithecia inside. Scale bar = 50 um.

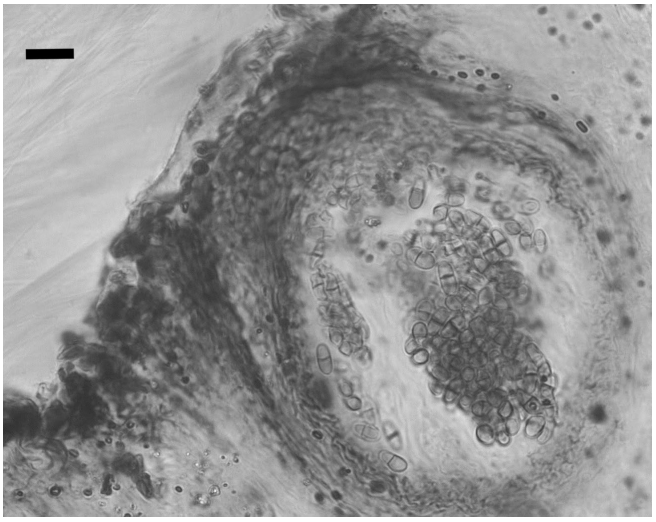

Figure 3. *Muellerella thalamita* (*H-NYL 3744*), vertical section of perithecium with multispored ascus. Scale bar = 10 um.

Mycoporum eschweileri (Müller Arg.) R.C. Harris

BM 05: *Coccoloba uvifera*, 10 m, *Be 19558*. – BM 09: *Rhizophora mangle*, 2 m, *Be 19623*, *19625*, *19652*, *20033*; conf. A. Aptroot. – BM 16: *Casuarina equisetifolia*, *Be 19624*.

Mycoporum sparsellum Nyl.

BM 09: *Rhizophora mang*le, 2 m, *Be 19652*.

Nadvornikia hawaiiensis (Tuck.) Tibell

This is one element of an interesting assemblage of lichens found exclusively (or nearly exclusively) on decorticated Bermuda Cedar trees (see Introduction).

BM 06: on decorticated *Juniperus bermudiana*, *Be 22333*, *22454*, *22455*.

Nadvornikia sorediata R.C. Harris

BM 09: on *Juniperus bermudiana*, *Be 20062* (dupl. in BM; stictic acid and xanthone by TLC), *Be 20125* (TLC: contains xanthones, terpenoid; thallus P+ orange, K+ yellow turning red). – BM 23: on *Juniperus bermudiana*, *Be 22413*.

Orcularia insperata (Nyl.) Kalb & Giralt

Reported originally by Crombie (1877) as *Lecidea insperata*, the host of *Muellerella thalamita*; included in Riddle (1916: 159) as *Rinodina insperata*. Recently reported from North America (Lendemer et al. 2008).

BM 05: old leaf stem of *Zamia* sp., *Be 19577*. – BM 09, *Juniperus bermudiana*, *Be 23974*. – BM 15: *Be 22794*, *22795*.

****Orcularia placodiomorpha*** (Vainio) Kalb & Giralt

According to Marbach (2000), this species was known previously only from South America; however, it is also included in the checklist of North America (Esslinger 2014).

BM 02: sandstone tombstone, *Be 22310*, *22396*. – BM 04: *Coccoloba uvifera,* Be 20048. – BM 05: on leaf stem of *Zamia* sp., *Be 19574*, *19599*. – BM 25: *Rhizophora mangle*, *Be 22309*.

****Opegrapha calcarea*** non Turner ex Sm. & Sowerby

The first author has collected a number of different, saxicolous species of *Opegrapha* in Bermuda which will be treated in a future publication.

BM 23: on shaded limestone overhang, 10 m, *Be 20192*, *20119*. – BM 27: on limestone rock above harbour, 8 m, *Be 20118*.

Opegrapha vulgata Ach.

Previously reported by Riddle (1916: 150). The shape of the spores is the only difference between our Bermuda specimen and European material: in the latter, the spores are more fusiform, with the third and fourth cells slightly swollen.

BM 09: *Myrica cerifera*, *Be 20115*.

****Parmotrema cristiferum*** (Taylor) Hale

BM 03: *Casuarina equisetifolia*, *Be 19645*. – BM 05: *Cocos nucifera*, *Be 24020*. – BM 08: *Leucaena* sp., *Be 22429*. – BM 09: *Rhizophora mangle*, *Be 19637*. – BM 17: *Juniperus bermudiana*, *Be 20162*. – BM 21: *Rhizophora mangle*, *Be 20164*.

****Parmotrema peralbidum*** (Hale) Hale

Parmotrema peralbidum is morphologically very similar to *P. tinctorum*, which differs in its undersurface: there are many bulbs at the base of the rhizines in the latter species, as opposed to few in the former. The form of the isidia also differs in these two species: both have laminal, dense, short isidia; however, they are homogenous sphaerically (i.e, clustered like grapes) in *P. tinctorum* while smaller, and tuberous to prickly at the ends in *P. peralbidum*.

In addition, the two species differ chemically: *Parmotrema peralbidum* contains protocetraric acid in the medulla, while *P. tinctorum* produces lecanoric acid. Because we did not find any *Parmotrema tinctorum* among our recent Bermudian collections, we suspected that historic reports of *P. tinctorum* from Bermuda may have actually been *P. peralbidum*. Morphological examination and TLC analysis of historic collections, however, confirmed previous reports of *P. tinctorum*. *Parmotrema tinctorum*, which was apparently widespread historically, appears (for some reason) to have now been extirpated in Bermuda.

BM 20: *Leucaena* sp., *Be 19638*. – BM 21: *Rhizophora mangle*, 2 m, *Be 19636*, *19637*. – BM 06: *Casuarina equisetifolia*, *Be 19645*.

Historic *Parmotrema* specimens confirmed as *P. tinctorum*: *Chall. Exp.* (!BM, BM barcodes BM000764661, *ex* K; BM000764662; both conf. J. Elix by morphological examination and TLC). – Devonshire Parish, Devonshire Marsh, on *Myrica cerifera*, 28.3.1933, *Rendle 438a* (!BM, BM barcode no. BM000764663; conf. S. LaGreca, but TLC not performed).

****Parmotrema reticulata*** (Taylor) Hale

Abundant on various trees; also on wood and siliceous tombstones in well-lit sites.

BM 08: *Leucaena* sp., *Be 22428*. – BM 09: *Rhizophora mangle*, 2 m, *Be 19618*, *19640*, *20165*. – BM 11: *Roystonia regalis*, *Be 20166*. – BM 25: decorticated *Juniperus*, *Be 22427*. – BM 27: corticolous, *Be 20197*.

Parmotrema ultralucens (Krog) Hale

BM 11: on *Roystonia regalis*, covering the trunk together with other lobate Parmeliaceae (e.g. *Parmotrema reticulata*), *Be 22430*.

Paulia cubana (Tuck.) Henssen

Castle Harbor, on rocks, *S. Brown 629* (!FH, FH barcode no. 00079911); conf. M. Schultz.

Paulia myriocarpa (Zahlbr.) Henssen

Described from Puerto Rico and subsequently reported from Bermuda (Henssen & Tretiach 1995), the specimens below are the second and third specimens collected in Bermuda.

Hamilton Parish, Cockroach Rock, on N side of Harrington Sound across from Abbott's Cliff, on limestone, 0 m, 32°20'24"N – 64°43'28"W, 14.8.2006, *LaGreca 1550* (BM barcode no. BM000731141; dupl. in HBG), *LaGreca 1551* (HBG); both det. M. Schultz.

Paulia tessellata Henssen

This species was described by Henssen (1986) from collections made at Blue Hole, very close to where our collection was made.

BM 21: on coastal limestone, *Be 22431*; conf. M. Schultz.

##Peridiothelia fuliguncta (Norm.) D. Hawksw.

BM 09: *Rhizophora mangle*, 2 m, *Be 19644*.

Petractis farlowii (Tuck. ex Nyl.) Vězda

= *Gyalecta farlowii* Tuck. ex Nyl.

This species was described from Bermuda by Tuckerman in Nylander (1890) from a specimen collected by W.G. Farlow; it has since been reported from the Ozarks and southeastern North America. In Bermuda today, it is only found on shaded, hard limestone overhangs in two locations: Walsingham Jungle and Whalebone Bay. It is much more abundant at the latter location.

BM 23: on a shaded, hard limestone overhang, 5 m, *Be 20082*, *22382*, *22480*, *24044*, *24056* (with *Cryptothecia striata* and *Ionaspis tropica*). – St. George's Island, Whalebone Bay, 12.8.2009, *Be 24067*.

Phaeographis dendritica (Ach.) Müller Arg.

BM 15: *Celtis laevigata*, *Be 22335*, *22340*. – BM 08: *Croton* sp., *Be 22438*.

Phaeographis inusta (Ach.) Müller Arg.

BM 09: *Sabal bermudana*, *Be 20132*, *20168*, *20169*. – BM 15: *Celtis laevigata*, *Be 22787*. – BM 17: *Juniperus bermudiana*, *Be 20199*.

Phaeographis lobata (Eschw.) Müller Arg.

BM 09: on twigs of *Rhizophora mangle*, 2 m, *Be 19598*, *19641*, *20080*; all conf. B. Staiger. *Chall. Exp.* (!BM, BM Barcodes BM000921326, originally identified as *Phaeographis punctiformis* (Eschw.) Müll. Arg.; BM000921327, originally identified as *Phaeographis punctiformis* (Eschw.) Müll. Arg.; BM000764729, *ex* K; BM000764730).

Phaeographis punctiformis (Eschw.) Müller Arg.

Old material from Bermuda under this name is now designated as *P. lobata*. *Phaeographis punctiformis* s.str. is also present but appears to be extremely rare.

BM 09: *Rhizophora mangle*, *Be 20130*.

Physcia atrostriata Moberg

BM 09: 2 m, *Rhizophora mangle*, *Be 19650*. – BM 10: on limestone, *Be 20090*. – Warwick Parish, Railway Trail, on *Juniperus bermudiana,* 15 m, 32°15.95´N, 64°48.3´W, 5.5.2005, *Be 20135*. – BM 17: *Juniperus bermudiana*, 60 m, *Be 20087*, *20091*. – BM 20: *Leucaena* sp., *Be 19649*. All material det. R. Moberg.

Physcia neogaea R.C. Harris

This is the most common *Physcia* sp. in Bermuda, occurring on palms and other trees near the coast.

Paget Parish, Railway Trail, in shaded hedgerow on *Casuarina equisetifolia*, 40 m, 12.11.2004, *Be 19645*. – BM 05: *Coccoloba uvifera*, *Be 19648*; *Cocos nucifera*, frequent, n.c. – B07: *Coccoloba uvifera*, *Be 19647*. – BM 08: *Croton* sp., *Be 22438*. – BM 09: *Sabal bermudana*, *Be 20156*. – BM 20: *Leucaena* sp., *Be 19588*. – BM 21: *Rhizophora mangle*, *Be 20134*; det. R. Moberg.

Physcia phaea (Tuck.) J.W. Thomson

BM 08: on marble tombstone, *Be 22439*.

Physcia sorediosa (Vain.) Lynge

BM 17: *Juniperus bermudiana*, 60 m, *Be 20089*. Church Cave, on bark, *E.G. Britton 1080* (!NY; conf. J.W. Thomson).

Placynthium stenophyllum (Tuck.) Zahlbr.

This species was recorded in association with *Paulia tesselata* from Walsingham in Henssen (1986: 227). Although we have not seen any specimens of this lichen from Bermuda (they may be in Hb. Henssen), we are repeating Henssen's record to ensure it is not forgotten.

Porina aenea (Wallr.) Zahlbr.

BM 07: on shrubs in shade, 10 m, *Be 19654*.

Porina atlantica (Erichs.) P.M.Jörg.

= *Porina nucula* auct. europ. non Ach.

This material corresponds exactly with the species description given for material from Laurimacaronesia (Sèrusiaux et al. 2007).

BM 09: *Rhizophora mangle*, 2 m, *Be 20142*. – BM 23: decorticated *Juniperus bermudiana*, *Be 22441*.

Porina internigrans (Nyl.) Müller Arg.

A fine picture of this rarely collected lichen from Saba (Netherlands Antilles) can be found at http://www.tropicallichens.net/4468.html

BM 09: *Rhizophora mangle*, *Be 20142*; det. A. Aptroot.

Porina leptalea (Durieux et Mont.) A.L. Sm.

BM 09: *Rhizophora mangle*, *Be 20145*. – BM 15: *Celtis laevigata*, *Be 22778*, *22786* (leg. A. Glasspoole).

Porina nucula Ach.

This lichen is characterised by its tuberculate, ochre-coloured thallus and perithecia up to 0.4 mm in diameter, covered by a thalline layer up to the small ostiole. The excipulum is KOH+ red-orange. Its spores are 7-septate, 35 x 7 µm. There is an historic specimen from Bermuda in NY (*E.G. Britton 363*; Riddle 1916: 147) but we have not critically re-examined it yet.

This is a rather common species of shaded, smooth bark of various trees.

BM 09: *Rhizophora mangle*, 2 m, *Be 20142*, *24026*. – BM 23: *Eugenia* sp., *Be 22442*; *Juniperus bermudiana*, *Be 22441*.

****Porina subinterstes*** (Nyl.) Müller Arg.

BM 05: in the understory on ?*Eugenia*, *Be 195711*; det. A. Aptroot.

****Protoparmelia isidiata*** Diederich, Aptroot & Sérusiaux

This lichen has a sterile, grey thallus with minute, densely arranged simple isidia with dark tips, surrounded by a thin, dark prothallus. Colour reactions: KOH-, C-, P-, KC+ pink. TLC: nornonatic acid (=4-*O*-methylnotatic acid).

The type location of this recently described lichen is in Papua New Guinea, but it is widely distributed in southeastern North America (Lendemer & Lumbsch 2008) and Brazil (Kalb 2004).

BM 09: on *Sabal bermudana*, 1 m, *Be 20152*, *20153*, TLC by W. Obermayer; both det. A. Aptroot. – BM 23: lignicolous on *Juniperus bermudiana*, *Be 22456*.

****Pseudosagedia cestrensis*** (Michener) R.C. Harris

Frequent in shady *Eugenia uniflora* thickets. Using the key and description in Smith et al. (2009), all our Bermuda specimens would be identified as *P. borreri* (Trevisan) D. Hawksw. A firm delimitation from this European taxon on the basis of morphological features is currently not possible; molecular work is necessary to ascertain the correct taxonomic status of *P. cestrense*.

Spores dimensions of specimens cited here are 30-37 x 4 µm.

BM 01: *Be 22444*. – Warwick Parish, Railway Trail, *Eugenia uniflora*, 40 m, *Be 20071*, *20146*; det. A. Aptroot. – BM 15: *Celtis laevigata*, *Be 22323*. – BM 17: *Coccoloba uvifera*, *Be 20144*.

****Pyrenula acutalis*** R.C. Harris

BM 23: *Cassine laneana*, *Be 20149*; *Eugenia uniflora*, *Be 22447*, *22449*.

Pyrenula cocoes Müller Arg.

This is a conspicous *Pyrenula* with a cream-white, UV + yellow thallus. It grows on the smooth barks of various trees in sunny situations. All material cited by Riddle (1916: 148) as *Pyrenula leucoplaca* (Wallr.) Koerb. is actually *P. cocoes* (seven specimens total, all det. R.C. Harris). Historic specimens are also listed as *P. farrea* (Ach.) Branth. & Rostr. in Waterston (1947): e.g. Tucker's Town, on *Eugenia*, August 31-September 20, 1905, *Britton 315* (!NY; det. R.C. Harris).

BM 03: shaded hedgerow, 40 m, *Be 19665*. – BM 09: 5 m, *Rhizophora mangle*, *Be 19664*, *19658*, *19668* (the preceding three all det. A. Aptroot), *20134*, *20148*, *20151*. – BM 21: *Coccoloba uvifera*, *Be 19635*. – BM 29: *Rhizophora mangle*, *Be 22362*.

****Pyrenula concatervans*** (Nyl.) Müller Arg.

This uncommon *Pyrenula* prefers smooth, shaded bark. It bears perithecia that are almost fully immersed, and possesses a conspicuous, dull green, chondroid, UV- thallus. Three of the four specimens listed by Riddle (1916: 148) as *Pyrenula nitida* (Weigel) Ach. var. nitidella (Flörke ex Schaer.) Schaer. are actually *P. concatervans* (!NY; all three det. R.C. Harris). The exception is *E.G.Britton 1081*, which could not be located in NY by the junior author.

BM 05: *Coccoloba uvifera*, 10 m, *Be 19622*; det. A. Aptroot. – BM 09: *Myrica cerifera*, 2 m, *Be 19661*, *24030*. – BM 21: *Rhizophora mangle*, 5 m, *Be 19667*, *19664*; det. A. Aptroot.

Pyrenula confinis (Nyl.) R.C. Harris

BM 21: on twigs of *Rhizophora mangle*, 5 m, *Be 19668*; det. A. Aptroot.

Pyrenula ochraceoflava (Nyl.) R.C.Harris

BM 08: palm stem, *Be 22445*, *24031*. – BM 09: *Sabal bermudana*, *Be 20152*; det. A. Aptroot. – BM 23: *Sabal bermudana*, *Be 22445*.

Pyrrhospora quernea (Dicks.) Körb.

BM 09: on decorticated *Juniperus bermudiana*, *Be 22351*.

Pyxine eschweileri (Tuck.) Vain.

BM 05: *Cocos nucifera*, 8 m, *Be 20157*.

Pyxine subcinerea Stirton

BM 09: *Myrica cerifera*, *Be 19656*.– BM 17: *Juniperus bermudiana*, *Be 20141*. – BM 20: *Leucaena* sp., *Be 19657*.

Rinodina colobinoides (Nyl.) Zahlbr.

This is a species with a wide subtropical and tropical distribution. It is the only *Rinodina* species in Bermuda.

BM 05: at the entrance of the Middleton House, *Cocos nucifera*, *Be 20167*; det. J.W. Sheard. – BM 06: in shaded hedgerow, *Be 19678*; det. J.W. Sheard. – BM 11: *Ficus* sp., *Be 19679*; det. H. Mayrhofer.

Sarcographa tricosa (Ach.) Müller Arg.

BM 09: on bark of dead *Rhizophora mangle*, 2 m, *Be 19590*, *19591*; det. B. Staiger.

Strigula americana R.C. Harris

BM 03: corticolous in shaded hedgerow, *Be 19607*.

Strigula bermudana (Tuck. ex Nyl.) R.C. Harris

This is by far the most frequent saxicolous lichen on native limestone in Bermuda. It prefers aeolian limestone, which has a high storage capacity for water; however, it can also be found on hard, humid limestone and artificial, calcareous substrates. In both situations, it is most common in shaded conditions.

BM 10: on mortar, *Be 20181*; det. O. Breuss. – BM 23: on limestone, *Be 20030*, *20031*, *20190*, *22467*, *22473*. – BM 27: on coastal limestone at the pier, 8 m, *Be 20032*; det. A. Aptroot.

Strigula phaea (Ach.) R.C. Harris

Previous known from the barks of trees in euoceanic habitats in western Europe, the southeastern USA, Puerto Rico and French Guyana. There is one historic specimen from Bermuda (Waterston 1947). Our Bermudian specimen is well-developed; it differs from typical *S. phaea* in the absence of conidiomata and the nearly naked ascomata, which possess only a basal thalline collar. However, the black ascomata do not exceed 200 µm in diameter, which agrees with the lower limit of the description of Roux and Sérusiaux (2004). Our specimen appears to be the first collection of this species on calcareous rock.

BM 23: on hard limestone beneath dense shrubs, *Be 22468*; conf. A. Aptroot. – Harrington House, on *Juniperus bermudiana*, 21.2.1908, *S. Brown 560* (!NY; conf. R.C. Harris and E. Sérusiaux).

Toninia aromatica (Sm.) A. Massal.

Occupying small spaces between thalli of *Verrucaria fusconigrescens*.

BM 05: on coastal limestone, 10 m, *Be 20186*. – BM 08: on aeolian limestone, *Be 24069*.

Verrucaria amylacea Hepp

Paget Parish, Railway Trail, section from Paget to South Coast Lane, on concrete, 30 m, 32°16′N, 64°47.3′W, 3.5.2005, *Be 20185*; det. O. Breuss.

Verrucaria anceps Kremp.

Our most well-developed specimens, from Paget Cemetery, are nearly identical macroscopically to *V. pinguicola*. They differ from *V. pinguicola* by possessing bigger spores (21 x 5.5-6 µm).

BM 08: on top of aeolian limestone wall beneath shrubs, with *Stromatella bermudana* and *Verrucaria baldensis*, *Be 22470*, *22481*, *24051*; det. O. Breuss. – BM 10: on mortar, *Be 20181*; det. O. Breuss.

Verrucaria aquatilis Mudd

This is an interesting record of a species otherwise known only from submerged, siliceous rocks in clean, freshwater rivulets in Europe. It is characterised by a translucent, gelatinous, nearly black thallus and very small spores. This occurence—anomalous because of its otherwise typical, permanently wet, amphibious habitat—is a testament to the very moist conditions prevailing on the Bermuda Islands.

BM 26: on dew-moistened limestone along a shaded path, *Be 20180*; det. O. Breuss.

Verrucaria banatica Servít

This specimen keyed out close to the *V. muralis* group, differing only by its bigger spores (28-32 x 10-12 µm) and an involucrellum that nearly extends to the base of the perithecia, which are 0.35–0.4 mm in diameter.

BM 08: on top of aeolian limestone wall, 10 m, *Be 22475*; vidit O. Breuss.

Verrucaria calciseda DC.

BM 24: hard limestone, 4 m, *Be 24050*, det. O.Breuss.

Verrucaria fusca Pers.

BM 10: aeolian limestone, 40 m, *Be 20182*, det. O.Breuss.

Verrucaria fusconigrescens Nyl.

BM 05: on coastal limestone, 10 m, *Be 20186*; det. O. Breuss.

Verrucaria halizoa Leighton

In Bermuda, this lichen does not occur in the littoral zone, as it does in other parts of the world. Instead, it is found on shaded rock faces very close to the ground, e.g. hard limestone in the Walsingham forest (c. 300 m from the coast).

BM 23: on shaded limestone overhang, 10 m, *Be 20191*, *22417*; det. O. Breuss. – BM 25: on hard limestone near the coast, *Be 22473*.

Verrucaria parmigerella Zahlbr.

All specimens cited below were found on shaded limestone.

BM 06: *Be 20052*. – BM 08: *Be 24069*. – BM 25: *Be 24047*.

Verrucaria cf. ***viridula*** (Schrader) Ach.

The spores of this specimen are slightly shorter than in Central European material.

Paget Parish, Railway Trail, cut-through east of South Coast Lane, on shaded limestone, 30 m, 3.5.2005, *Be 20176*.

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