

Additions to the lichens, allied fungi, and lichenicolous fungi of the Ottawa region in Ontario and Quebec, with reflections on a changing biota

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Abstract

The inventory of lichens, allied fungi, and their parasites in the Ottawa region has grown from 391 in 1988 to 543 today, almost entirely because of the discovery of species overlooked in previous years and the inclusion of fungal parasites. In addition, almost 140 names have changed with reclassifications and re-identifications. These changes are presented here together with a list of synonyms updating the 1988 list. Vouchers are cited for all new records, and notes are presented for many species neither described nor keyed out in easily accessible literature. Reference is made to the new, complete list of lichens and lichenicolous fungi available online. The new checklist includes one species new for North America (*Tremella christiansenii*); five species and one variety new for Canada (*Caloplaca parvula*, *Caloplaca reptans*, *Cladonia petrophila*, *Enchylium tenax* var. *ceranoides*, *Leprocaulon adhaerens*, and *Merismatium peregrinum*); four new for Ontario (*Caloplaca reptans*, *Kiliasia tristis*, *Lempholemma chalazanum*, and *Rinodina fimbriata*); and nine new for Quebec (*Arthonia helvola*, *Arthonia hypobela*, *Caloplaca parvula*, *Cladonia petrophila*, *Lempholemma chalazanum*, *Leprocaulon adhaerens*, *Merismatium peregrinum*, *Rimularia badioatra*, and *Tremella christiansenii*). Although the climate of the region is warming, especially with higher minimum temperatures in winter, the lichen biota has not increased as a result but, in fact, may be threatened by the effects of climate change on the health of the forests and the trees that support lichens. Air quality has improved in recent decades, allowing numerous lichens to again become established in urban areas. Local areas of especially rich lichen diversity can be found on both the Ontario and Quebec sides of the region, and some of these “hot-spots” are mentioned. Other factors influencing the decrease or increase of lichen cover are also discussed.

Key words: Eastern Canada; climate change; impoverishment of biota; urban lichens

Introduction

The lichen biota within a 50-km radius of the city of Ottawa (Figure 1) has received considerable attention since the days of John Macoun in the late 19th and early 20th centuries. In 1898, Macoun listed 152 species of lichens (Macoun 1898) and added 44 species eight years later (Macoun 1906) giving a total of 196 lichens. After Macoun, the next comprehensive listings were those of Brodo (1981), who reported 367 species, and Brodo (1988), with 391 species.

In the 30 years since publication of *Lichens of the Ottawa Region* (Brodo 1988), a tremendous amount of fieldwork has occurred, resulting in the discovery of 160 species beyond the nearly 400 previously known.

The lichenology staff of the Canadian Museum of Nature (CMN; I.M.B., P.Y.W., R.T.M.) and their students (Sharon Gowan, Hayley Paquette, and François Lutzoni) have been exploring and collecting throughout the region, while amateur naturalists (R.E.L. and C.F.) have chosen to study smaller segments (Stony Swamp in the Greenbelt and Gatineau Park, respectively) in some depth. Visiting lichenologists from Ontario’s Ministry of Natural Resources and Forestry (Sam Brinker and C.J.L.), other parts of North America (Stephen Clayden, Trevor Goward, Richard Harris, James Lendemer, Claude Roy, Steven Selva, and John Sheard), and Europe (Teuvo Ahti, André Aptroot, Ulf Arup, Stefan Ekman, David Hawksworth, Hannes

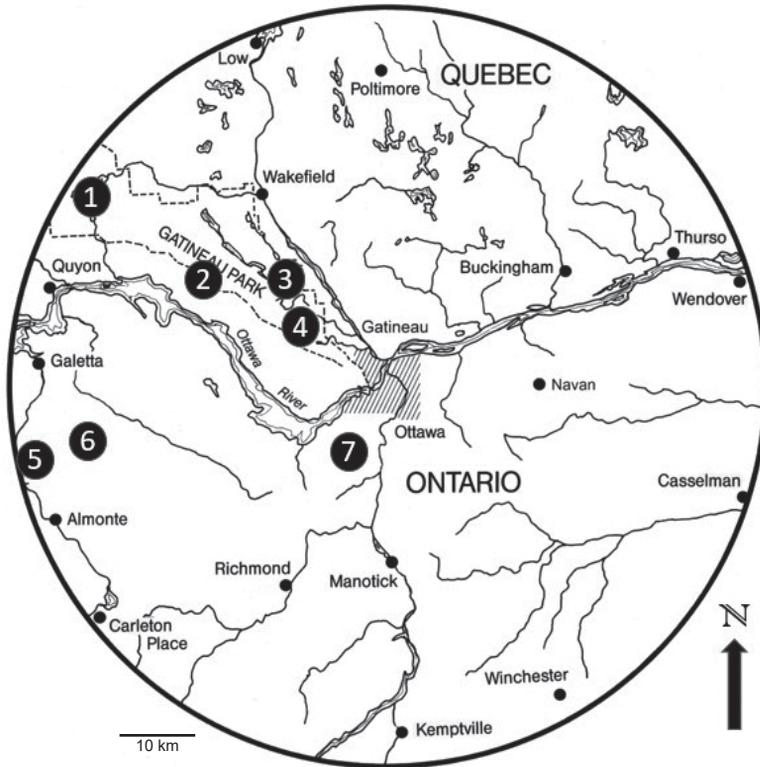


FIGURE 1. Ottawa Region, circumscribed as a circle with a 50-km radius from Parliament Hill, showing some important centres of lichen diversity (“hot-spots”). 1–4, Gatineau Park, Quebec. 1. Lac la Pêche; 2. Luskville Falls; 3. Lac Meech, MacDonald Bay; 4. King Mountain; 5. Blakeney Rapids Park, Mississippi Mills; 6. Burnt Lands Provincial Park, Almonte; 7. Ottawa Greenbelt, Stony Swamp (Macoun Club Study Area). Base map provided by Daniel Brunton and used with his permission.

Hertel, Ingvar Kärnefelt, Leif Tibell, and Tor Tønsgberg) have brought fresh eyes and vast experience to joint forays with I.M.B. All have made discoveries of taxa new to the region augmenting our knowledge of the lichen biota, and many have re-identified existing specimens in the National Herbarium (CANL).

More than a third of the species listed in Brodo (1988; 139/391) have been either reclassified and therefore renamed by other lichenologists, or the specimens on which the reports were made have been re-identified, usually by the lichenology staff of CMN and visitors to CANL. Together with another 160 species discovered through fieldwork, including 13 fungi parasitic on lichens (which were not covered in Brodo [1988]), a total of 299 new names have to be considered by those interested in Ottawa area lichens. We document these changes here.

Study Area

The circle defining the “Ottawa region” was drawn by local naturalists in John Macoun’s day with a 25-mile (40-km) radius from Parliament Hill (45°

25°29’N, 75°41’59’W), later expanded to 30 miles (48 km; Brunton 1988). Since 1981, with the introduction of metric measurements in Canada, the radius has been set at 50 km, encompassing about 7850 km² (Figure 1). The circle is centred on an urban area home to about one million people. As in other large cities with significant air pollution, the core is essentially a “lichen desert” (Brodo *et al.* 2001: 89), with only a small selection of common corticolous lichens (e.g., Hammered Shield Lichen [*Parmelia sulcata* Taylor], Candleflame Lichen [*Candelaria concolor* (Dickson) Stein], and Star Rosette Lichen [*Physcia stellaris* (L.) Nyl.]) found in inner-city parks and along the lower parts of the Rideau Canal and Rideau River and adjacent Ottawa River. Species richness improves somewhat in the surrounding suburbs, but even here, routine maintenance and replacement of structures and renewal of tree plantings generally preclude establishment of well-developed lichen communities. These urban/suburban areas occupy less than a tenth of the circle. Outlying woodlands that support

pollution-sensitive species cover more than a third of the area, with most of the remainder, almost half, being agricultural fields largely devoid of lichens. The status of the lichen biota vis-à-vis air quality and traffic in Ottawa was recently reviewed by Coffey and Fahrig (2012).

The region is bisected by the Ottawa River, which follows a geological divide and marks a political one. The land to the south (in the province of Ontario) is mostly underlain by flat-lying calcareous limestone of Paleozoic age, generally buried under beds of clay or sand. The often-exposed bedrock to the north (Quebec) is predominantly acidic granitic rock of the Precambrian Shield, which rises from the lower plain as an escarpment as much as 250 m high, with moderate relief behind it. Outlying exposures of both rock types occur on either side of the river, and glacially transported blocks of granite provide substrate for lichens restricted to acidic rocks in places well out onto the limestone plain.

In places, heavy late-glacial and post-glacial flows of water have stripped away the soft sediments altogether, leaving bedrock exposed. Flat-lying exposures of calcareous limestone now form a rare ecological formation known as an alvar, with examples that escaped industrial quarrying on both sides of the river.

Access to this diverse environment for the purpose of survey and collection has been facilitated by the establishment during the 20th century of substantial conservation areas as public lands, most notably by virtue of their size, Gatineau Park in Quebec and the Ottawa Greenbelt in Ontario. About two-thirds of the additional species reported here were found as a result of extended searches in these two areas.

The region experiences a humid continental climate, with hot, humid summers and very cold winters, classified as Dfb in the Köppen-Geiger climate classification system (Beck *et al.* 2018). With the current global warming trend (1981–2019), the mean annual temperature (as measured at the Environment and Climate Change Canada weather station on the Central Experimental Farm) was 6.6°C with average highs of 11.4°C and average lows of 1.9°C. The average high in July is 27°C and the average low in January is –14°C. Mean annual precipitation is about 920 mm, 750 mm as rain and 175 cm as snow. The record high and low temperatures, often of special biological significance (see Discussion below), are 38°C in July and –39°C in December, respectively (Wikipedia 2020 based on data compiled and summarized from Government of Canada [2020a]).

Methods

Additions to the lichen biota of the Ottawa region were recorded at CMN as they were discovered.

All new records were reviewed and the vouchers re-examined. Standard laboratory methods for morphological and chemical studies were used in identifying the lichens, as summarized in Brodo *et al.* (2001). Permits to collect vouchers were obtained from the National Capital Commission by I.M.B., C.F., R.E.L., C.J.L., R.T.M., and P.Y.W., and the vouchers were deposited in CANL, except for collections made by visitors to the Ottawa region: Lendemer (NY [New York Botanical Garden, Bronx, New York]), Roy (QFA [Université Laval, Québec]), Selva (UMFK [University of Maine at Fort Kent, Fort Kent, Maine]), Sheard (hb. Sheard), Hertel (M [Staatliche Naturwissenschaftliche Sammlungen Bayerns, München, Germany]), Goward (UBC [University of British Columbia, Vancouver]), and Tønserberg (BG [University of Bergen, Bergen, Norway]); acronyms according to Thiers [2019]).

Results

Over the past 32 years, new fieldwork and herbarium study have uncovered an additional 135 species and one variety of lichens, 12 unlichenized fungi related to lichen fungi, and two species of uncertain or varying lichenization. A recent surge in interest in lichen parasites has prompted us to include lichenicolous fungi (11 species).

Many of the additions to the list reflect a shift in attention to microlichens. This was made possible by the availability of newer, more comprehensive and practical taxonomic keys. In the 1988 checklist, 168 (43% of the species) were foliose and fruticose (macrolichens), which, however, constitute 19% of the new discoveries, with crustose lichens accounting for about 75% and lichen parasites much of the remainder. This suggests that some upper limit is being approached among lichens that are easily seen, and most future additions are likely to be the more inconspicuous crusts.

A large number of these records have already been published or are listed online, e.g., Freebury (2011) for Gatineau Park species; Lee (2011), for the western greenbelt of Ottawa; and elsewhere in the region (e.g., Lewis and Brinker 2017). All these additions are listed in List I below. List II is made up of 19 additional lichen records resulting from the re-identification of species included in Brodo (1988). Among the new records for Ottawa, one species is also new for North America, five species and one variety are new for Canada, four are new for Ontario, and nine are new for Quebec; these are presented in List IV.

In addition to these new records for the Ottawa region, 18 lichens previously known only from the Quebec side are now reported from the Ontario side

as well, and 15 species known only from the Ontario side are now also listed for Quebec. These can be found in List III.

Notes and comments on the species are made when appropriate in the compiled lists. The abbreviations ON and QU are included to indicate whether the species is known from the Ontario side of the Ottawa River or the Quebec side, respectively, as in Brodo (1988). One or two voucher specimens are briefly cited as well. (The abbreviation MCSA refers to the Macoun Club Study Area, between the Bells Corners and Bridlewood communities in west Ottawa.)

We are not introducing new or updated identification keys for the lichens of the region for several reasons. Of the 160 taxa listed as new records for the region (List I), 110 (69%) are included in the revised keys for the lichens of North America (Brodo 2016), and many of them are described and illustrated in Brodo *et al.* (2001), Hinds and Hinds (2007), or McMullin and Anderson (2014). Of the remaining 50 taxa not in those keys, 20 are either lichenicolous fungi, which are not covered in either the original Ottawa lichen inventory or in Brodo (2016), or are stubble lichens and fungi, the so-called calicioid species. The calicioids are almost all well covered in some recent, readily available articles (e.g., Selva and Tibell 1999; McMullin *et al.* 2018b; Gockman *et al.* 2020); most of the parasitic, lichenicolous fungi can be identified using the fairly comprehensive keys by Ihlen and Wedin (2008), which cover Swedish species. For these reasons, only brief notes will be included in the annotated lists, and only for the taxa not covered in the references above.

Annotated species lists

The additions and changes to the lichen biota of the Ottawa region are divided into five lists:

In **List I**, we present new records for the region.

List II gives the correct names of species whose earlier reports were based on misidentification, together with vouchers and the names under which they were originally reported.

List III presents all species for which we have new provincial records, e.g., species known only from the Quebec (QU) part of the region in 1988 but now known from the Ontario (ON) side as well, and *vice versa*. Here vouchers are given only for the newly reported provincial record.

List IV gives new reports for North America, Canada, and the provinces of Ontario and Quebec as a whole.

List V gives the current, accepted names for all species in Brodo (1988) whose names have changed since then owing to reclassification or other research. The entries in List II are repeated so that

the disposition of all the changed names in Brodo (1988) are accounted for.

Collections by I.M.B., C.J.L., T.M., C.F., and P.Y.W. are deposited at CANL; those of Lendemer are at NY; those of R.E.L. are either in CANL or his private herbarium (hb. Lee; collection too small to be divided). For most species entries, only one or two specimens are cited per provincial record, even though many may have been collected.

Lichenicolous fungi and other non-lichenized fungi are designated by the following symbols:

* = lichenicolous fungi (parasites on living lichens)

+ = saprophytic fungi related to either lichens or lichenicolous fungi, on various substrates

= fungi of uncertain status, e.g., those that are questionably or weakly lichen-forming; or algiculous/saprophytic; or parasitic when young but saprophytic or lichen-forming when mature; or lichenicolous lichens.

The complete up-to-date list of the 543 lichens and lichenicolous fungi of the Ottawa region has been posted on the website of the Ottawa Field-Naturalists' Club (<https://ofnc.ca/wp-content/uploads/2021/02/Lichens-of-the-Ottawa-Region-revised-2021-02-28.pdf>) and will be updated at least annually.

I. Species new for the Ottawa region

Acarospora americana H. Magn. ON: Ottawa, along Rideau River, Hog's Back, on granite, *Harris 12143* (NY); Ottawa, *Macoun 66*, 7 May 1897, CANL. The Harris specimen is cited in Knudsen *et al.* (2011) in a detailed discussion of the species with a full description and many excellent photos. The Macoun specimen is mentioned in Brodo *et al.* (2013).

Anaptychia crinalis (Schaer.) Vězda (syn. *A. setifera* Räsänen). ON: Ottawa, among mosses on rocks, with *Lempholemma polyanthes*, *Macoun 103*, 30 Aug. 1903, CANL 2693. With no modern collections of this charismatic lichen, the species is probably no longer present in the area.

Anisomeridium bifforme (Borrer) R.C. Harris. QU: Aylmer, on ash (*Fraxinus*), *Brodo 29775*.

Arthonia fuliginosa (Schaer.) Flot. ON: Bells Corners (MCSA), on thin bark of small Black Ash (dead from Emerald Ash Borer attack), *Lee 2426*. This is a relatively rare species found mainly on Eastern White Cedar (*Thuja occidentalis* L.) in old cedar swamps and humid forests in the Great Lakes region (CNALH 2020). It was first reported for North America from Michigan by Wetmore (1988) and for Ontario by Crowe (1994) based on Wetmore's collections from the Slate Islands off the north shore of Lake Superior. It was later recorded

- from the Bruce Peninsula (Brodo *et al.* 2013). Harris (2015) includes *A. fuliginosa* in his key to *Arthonia* with an illustration of its ascospores (sub “*Arthonia* sp. #2”). In our material, the ascomata are irregular, forming star-shaped clusters, dark brown, usually pruinose, with a whitish thallus that can sometimes be rather well-developed, usually turned yellow with potassium hydroxide (KOH). The spores are 4–6-celled with the uppermost cell larger than the others, 16–23 × 6–8 μm ($n = 18$).
- Arthonia helvola* (Nyl.) Nyl. ON: Bells Corners, Stony Swamp, on base of Paper Birch (*Betula papyrifera* Marshall), Brodo 32906. QU: Gatineau Park, Trail 05 near Asticou, on Yellow Birch (*Betula alleghaniensis* Britton), Lendemer 28299, Freebury 1449; Keogan Cabin, on *B. alleghaniensis*, McMullin 18784. If the exposed roots of Yellow Birch in mature maple (*Acer*) forests are closely examined, there is a good chance of finding the tiny bright orange ascomata of *A. helvola*. The pigment is an anthraquinone that turns purple with KOH. The ascospores are often hard to find, but they are 3-celled, tapered, with the top cell slightly larger than the others, ~8–12 × 3–5 μm (Harris 1977). These are apparently the first published records of the species from Quebec. It was first reported for North America from Michigan and Ontario by Harris (1977) but seems to be fairly common in its preferred habitats in eastern North America (CNALH 2018).
- +*Arthonia hypobela* Nyl. (syn. *A. caudata* Willey) ON: Bells Corners, Stony Swamp, on Eastern White Pine (*Pinus strobus* L.) twigs, Brodo 32918. QU: Gatineau Park, Church Hill, on *P. strobus*, Freebury 1443, det. Lendemer. This inconspicuous fungus is apparently restricted to the young, smooth bark of white pine appearing as tiny black dots on the dark bark. It is very common although rarely collected because it is so hard to see. The ascomata are black, round to irregular in shape, not pruinose, and produce comet-shaped, 4–8-celled ascospores that are 24–32(–37) × (4.0–)5.0–5.5 μm. The cells of the spores are about equal in length. McMullin *et al.* (2018a) recently reported it (sub *A. caudata*) as new to Nova Scotia, and McMullin and Lendemer (2016) listed it for southern Ontario. The species is, however, new for Quebec. The synonymy was reported in McMullin (2018).
- +*Arthonia quintaria* Nyl. ON: Ottawa, Bells Corners, Stony Swamp, on maple (*Acer*), Lendemer 28140 (NY).
- Arthothelium anastomosans* (Ach.) Arnold. QU: Gatineau Park, Meech Lake, on old poplar (*Populus*), Brodo 25003.
- Arthrosporum populorum* A. Massal. ON: Bells Corners, Stony Swamp (MCSA), on young Basswood (*Tilia americana* L.) trunk, Lee 1120. QU: Gatineau Park, Luskville Falls, corticolous on *Populus*, McMullin 18757.
- Bacidia circumspecta* (Nyl. ex Vain.) Malme. ON: Renfrew County, Stubirski Lake, near Madawaska River, on cedar, Wong 3809, det. Ekman 1994.
- Bacidia laurocerasi* (Del. ex Duby) Zahlbr. (confirmed for region). ON and QU: see Ekman (1996).
- Bacidia subincompta* (Nyl.) Arnold. QU: Gatineau Park, Chelsea, on shaded base of old Sugar Maple (*Acer saccharum* Marshall) near swamp, Brodo 32405.
- Bacidina egenula* (Nyl.) Vězda. ON: Ottawa, Rockcliffe Park, on White Elm (*Ulmus americana* L.), M. Robitaille 149.4, det. Ekman 1994.
- Biatora printzenii* Tønsberg. QU: Gatineau Park, Luskville Falls, on Northern Red Oak (*Quercus rubra* L.), Tønsberg, B 21893 (BG) (Tønsberg 2002).
- Bryoria nadvornikiana* (Gyelnik) Brodo & D. Hawksw. QU: Gatineau Park, Trail 53, on Eastern Hemlock (*Tsuga canadensis* (L.) Carrière), Freebury 1654.
- Buellia griseovirens* (Turner & Borrer ex Sm.) Almb. ON: Fitzroy Harbour, on old fence along road, Brodo 33178. QU: Gatineau Park, Chelsea, on fallen *A. saccharum*, Brodo 32408.
- Buellia schaeferi* De Not. ON: Renfrew, on *Tsuga*, Brodo 31713A.
- Calicium parvum* Tibell. ON: Bells Corners, Stony Swamp (MCSA), on rotted wood in old *Thuja* swamp, Lee 2195.
- Caloplaca ahtii* Søchting. ON: Ottawa-Carleton County, South Gloucester, on Staghorn Sumac (*Rhus typhina* L.) near trail, Brodo 25489, det. Søchting. QU: Aylmer, on Trembling Aspen (*Populus tremuloides* Michaux), Brodo 28935, 28937A, det. Wetmore.
- Caloplaca chlorina* (Flot.) H. Olivier. ON: Ottawa, Riopelle Island, north-facing cliff, at base of a young *Q. rubra*, Brodo 29530; on limestone at edge of escarpment, Brodo 29520.
- Caloplaca parvula* Wetmore. QU: Gatineau Park, near Pink Lake, on *Quercus*, Goward and Clayden 82-73 (UBC); Aylmer, in wet woods under hydro lines, Lendemer 28164 (NY); Cte. de Jacques-Cartier, Stoneham, on base of dead *Fagus*, Brodo 29427. *Caloplaca parvula* is easily identified by its small polarilocular spores (10–12.5 × 4.0–5.5 μm) having a very narrow isthmus in combination with its tiny black apothecia (under 0.3 mm in diameter) and grey non-soresiate thallus, all negative with KOH. It grows on deciduous trees, often in

- hardwood swamps. This rare lichen was described from Minnesota by Wetmore (1994), but it is also known from northern Michigan (CNALH 2018). In Canada, it is only known from the Ottawa region and Stoneham, near Quebec City (both cited above). It is new for Quebec and Canada.
- Caloplaca pyracea* (Ach.) Th. Fr. QU: Gatineau Park, Luskville Falls Trail, parking lot, on *Populus*, *McMullin 18754*.
- Caloplaca reptans* Lendemer & B.P. Hodk. ON: Cunningham Island, Champlain Bridge area, on erratic in partial shade, *Brodo 29514*. *Caloplaca reptans* is a sterile, sorediate lichen with a grey-green to brownish thallus and grows on non-calcareous rocks (Hodkinson and Lendemer 2012). The thallus is dispersed areolate with areoles 0.2–0.3(–0.5) mm in diameter, the areoles sometimes becoming somewhat lobulate at the margins. The soralia are laminal or marginal and contain fine, pale, creamy white soredia. This recently described species was previously known only from the Appalachian Mountains (Hodkinson and Lendemer 2012). It is new for Canada and Ontario.
- Caloplaca subsoluta* (Nyl.) Zahlbr. ON: Ottawa, Vincent Massey Park, on top surface of limestone boulder at falls, *Brodo 29213*. QU: Gatineau Park, base of King Mountain near Baillie Rd., on HCl-rock, *Freebury 1404*. We are including here Ottawa specimens previously identified as *Caloplaca velana* (A. Massal.) DuRietz (see Arup 1990; Wong and Brodo 1992; Brodo 2016).
- Candelariella lutella* (Vain.) Räsänen. ON: Ottawa, Vincent Massey Park, on dead bark, *Freebury 2181*. QU: Gatineau (Aylmer), on fallen Balsam Poplar (*Populus balsamifera* L.), *Brodo 33112B*
- Catillaria lenticularis* (Ach.) Th. Fr. QU: Pontiac County, Knox Landing sud, près de la pointe Ross, les alvars de la région du Lac des Chats, dallage calcaire fracturé et altéré, *Roy 99-4387C* (QFA).
- Catillaria nigroclavata* (Nyl.) Schuler. ON: Richmond, on *Q. rubra*, *Brodo 27633*; Bells Corners, Stony Swamp (MCSA), on Butternut (*Juglans cinerea* L.) branch, *Lee 1113*. QU: Lac la Pêche, on *Thuja*, *Brodo 33081*; Lac Richard, on *Thuja*, *Freebury 700*.
- Chaenotheca chrysocephala* (Ach.) Th. Fr. ON: Bells Corners, Stony Swamp (MCSA), on weathered Larch (*Larix*) wood, *Lee 2208*.
- Chaenotheca gracilentia* (Ach.) J. E. Mattsson & Middeleb. ON: Bells Corners, Stony Swamp (MCSA), on basal bark of old *T. occidentalis* in old *Thuja* swamp, *Lee 2173*.
- Chaenotheca laevigata* Nád. ON: Bells Corners, Stony Swamp (MCSA), on old *T. occidentalis* in old *Thuja* swamp, *Lee 2182*.
- Chaenotheca trichialis* (Ach.) Th. Fr. ON: Bells Corners, Stony Swamp (MCSA), on weathered *Larix* lignum, *Lee 2185*.
- Chaenotheca xyloxena* Nád. ON: Ottawa, Delzotto Avenue and Quin Avenue, old-growth Red Ash (*Fraxinus pennsylvanica* Marshall) swamp, lignicolous on *T. occidentalis*, *Selva 8998* (UMFK). QU: Gatineau Park, Luskville Falls, lignicolous, on *P. strobus* snag, *McMullin 18779*.
- +*Chaenothecopsis perforata* Rikkinen & Tuovila. ON: Fletcher Wildlife Garden, on *R. typhina* resin, *McMullin 20104*. QU: Gatineau Park, Luskville Falls parking lot, on *R. typhina* resin, *McMullin 19165*. Although not listed in Esslinger (2019), this species was recently reported as new to North America, Canada, Quebec, and Ontario by Gockman *et al.* (2019).
- #*Chaenothecopsis pusiola* (Ach.) Vain. ON: Bells Corners, Stony Swamp (MCSA), on weathered *Larix* lignum, *Lee 2184*.
- +*Chaenothecopsis savonica* (Räsänen) Tibell. ON: Bells Corners, Stony Swamp (MCSA), on softly rotted wood of tottering deciduous tree in old *Thuja* swamp, *Lee 2210*.
- Cladonia farinacea* (Vain.) A. Evans. ON: Bells Corners, Stony Swamp, *Brodo 28702*.
- Cladonia floerkeana* (Fr.) Flörke. ON: Fitzroy Harbour, on stump in partial shade, *Brodo 33157*.
- Cladonia gracilis* (L.) Willd. subsp. *turbinata* (Ach.) Ahti. QU: Gatineau Park, Hope's Trail, Lac Meech, on soil, *Hanes s.n.*, CANL 096116.
- Cladonia ochrochlora* Flörke. ON: Bells Corners, Stony Swamp, on log, *Lendemer 28132* (NY). QU: Gatineau Park, Kidder Lake, on thin soil in forest glade, *Freebury 240*, det. Brodo.
- Cladonia petrophila* R.C. Harris. QU: Gatineau Park, Faris Creek, on rock, *Freebury 1439*, det. Lendemer. This lichen is an addition the lichen biota of Canada as well as Quebec.
- Cladonia subulata* (L.) F.H. Wigg. ON: Bells Corners, Stony Swamp, alvar, *Brodo 28889*.
- **Clypeococcum hypocenomycis* D. Hawksw. QU: Chelsea, parasitic on *Hypocenomyce scalaris* (Ach. ex Lilj.) M. Choisy, *Freebury 1135*; Gatineau Park, Keogan Cabin, parasitic on *H. scalaris*, *McMullin 18782*.
- **Cornutispora lichenicola* D. Hawksw. & B. Sutton. QU: Gatineau Park, on *Punctelia rudecta* (Ach.) Krog on dead wood, *R. Lowan 270* (NY), ver. R.C. Harris.
- Cresponea chloroconia* (Tuck.) Egea & Torrente. ON: Gloucester, on *B. alleghaniensis*, *Wong 4518*. QU: Gatineau Park, Meech Lake, *Hanes s.n.*, CANL 96175.

- Dictyocatenulata alba* Finley & E.F. Morris. ON: Ottawa, Stony Swamp, on *B. papyrifera* base, *Lendemer 28142* (NY). QU: Gatineau Park, Church Hill; base of *B. alleghaniensis*, *Freebury 1445*, det. Lendemer; on *B. alleghaniensis*, *Lendemer 28317* (NY). This lichenized hyphomycete, reported for Canada by Seifert *et al.* (1987) as an unlichenized fungus, is recognized by its curious white, stalked synnemata, 1–1.5 mm tall, producing at the tips a mass of colourless, broadly ellipsoid, muriform conidia, 7–18 × 7–11 µm; it is not known to produce ascomata. Lendemer and Harris (2004) discuss its symbiotic nature and describe the species, which is usually found on the exposed roots of *B. alleghaniensis*. There is a particularly good description with many photographs in Diederich *et al.* (2008).
- **Didymocyrtis epiphyscia* Ertz & Diederich (syn. *Phoma physciicola* Keissler). QU: Gatineau Park, Trail 53 near La Pêche River, on *Physcia aipolia* (Ehrh. ex Humb.) Fűrnr., *Freebury 1119A*.
- **Didymocyrtis xanthomendozae* (Diederich & Freebury) Diederich & Freebury (syn. *Phoma xanthomendozae* Diederich & Freebury). QU: Gatineau Park, Trail 53 near La Pêche River; on *Xanthomendoza hasseana*, *Freebury 1413*.
- #*Diploschistes muscorum* (Scop.) R. Sant. ON: Lanark County, Burnt Lands, *Brodo 32625*. QU: Gatineau Park, Luskville Falls, on *Cladonia*, *Brodo 5587*, det. Lumbsch.
- Diplotomma alboatrum* (Hoffm.) Flot. ON: Dunrobin, Sheila McKee Park, on limestone cliff, *Lewis 2226*, with *J. Devlin*.
- Enchylium tenax* (Sw.) Gray var. *ceranoides* (Borrer) Cl. Roux *comb. prov.* (Gérault 2020). ON: Panmure Alvar, calcareous soil, *Lewis 2236b*; Burnt Lands Provincial Park, calcareous soil, *Lewis 2302*. *Enchylium tenax s. str.* is the most common, soil dwelling, *Collema*-like species in Ontario (Brodo *et al.* 2001, *sub Collema tenax*). It is notoriously variable, taxonomically complex, and difficult to identify correctly, with a number of morphotypes potentially attributed to environmental conditions (Jørgensen and Goward 2015). Degelius (1954) recognized seven varieties in his monograph on the European species. The material cited here represents the first vouchered published report of *E. tenax* var. *ceranoides* from Ontario. It is found growing on calcareous soil and is rarely fertile, unlike *E. tenax* var. *tenax* which is highly fertile. *Enchylium tenax* var. *ceranoides* has digitate, erect, vertical lobes, compared with the prostrate lobes or lack of lobes of *E. tenax* var. *tenax*, and the lobes are swollen when wet (Degelius 1954; Gilbert *et al.* 2009).
- Enterographa zonata* (Körb.) Källsten (syn. *Opegrapha zonata* Körb.). QU: Gatineau Park, Trail 5 near Asticou on rock, *Lendemer 28300* (NY).
- Fuscidea arboricola* Coppins & Tønsberg. ON: Prescott and Russell County, Larose Forest, on *A. rubrum* by creek, *Brodo 31802*. QU: Aylmer, on *A. rubrum*, *Brodo 28912*.
- Fuscidea recensa* (Stirt.) Hertel, V. Wirth & Vězda var. *arcuatula* (Arnold) Fryday. QU: Gatineau Park, Trail 5, Asticou, on rock, *Lendemer 28301* (NY).
- Gyalecta fagicola* (Hepp ex Arnold) Kremp. (syn. *Pa-chyphiale fagicola* (Arnold) Zwackh). ON: Ottawa, Gloucester, cedar swamp, on maple, *Wong 4540*.
- Gyalecta truncigena* (Ach.) Hepp. ON: Richmond, on *P. balsamifera*, *Brodo 27627*.
- Halecania* sp. QU: Gatineau Park, King Mountain off Mountain Rd., on shaded siliceous rock, *Brodo 32685a*. This interesting but inconspicuous crustose lichen is under study by Richard Harris and Doug Ladd and will be described as new based on collections from the Ozark Mountains. Its thin, areolate to subsquamulose thallus stains red with para-phenylenediamine (PD) under the apothecia and in the apothecial margins. The reaction is due to argopsin, found in several other species of *Halecania* such as *H. micacea* Fryday & Coppins, a rare British species with a dispersed areolate thallus. The 2-celled ellipsoid spores of the Ottawa specimen are (9.3–)10.3–11.8(–12.5) × 3.6–5.2 µm.
- Heppia adglutinata* (Kremp.) A. Massal. ON: Panmure Alvar, Timmins Road, on calcareous soil, *Lewis 2235*, with *J. Devlin*.
- **Illosporopsis christiansenii* (B.L. Brady & D. Hawksw.) D. Hawksw. QU: Gatineau Park, Luskville Falls, on *Physcia* sp., *Brodo 32142*.
- **Illosporium carneum* Fr. QU: Gatineau Park, Lac Ramsay, on *Peltigera* sp., *Brodo 14628*.
- Inoderma byssaceum* (Weigel) Gray (syn. *Arthonia byssacea* (Weigel) Almq.). ON: Gloucester, Albion and Leitrim Roads, on White Cedar, *Wong 4522*; Ottawa, Black Rapids, on *T. americana*, *Brodo 27669*. QU: Gatineau Park, Lac Meech, on island in MacDonald Bay, on *Acer*, *Brodo 29726*.
- Ionaspis alba* Lutzoni. ON: Bells Corners, Stony Swamp (MCSA), on a non-calcareous sandstone boulder in a mature hardwood forest, *Lee 1991*. QU: Chelsea, on granitic outcrop in old *Acer* forest, *Brodo 32406*, with *C. Freebury*.
- Kiliasia tristis* (Müll. Arg.) Hafellner (syn. *Toninia subnitida* (Hellb.) Hafellner & Türk.). ON: North Gower, on stone in partly shaded area, under *Thuja* and Balsam Fir (*Abies balsamea* (L.) Miller), *Brodo 22760*. The classification of *K. tristis* has changed several times over the past 40 years.

As a species of *Catillaria*, *C. tristis* (Müll. Arg.) Arnold, it was included in the monograph on saxicolous species of *Catillaria* by Kiliias (1981). Hafellner (1984) noted that in species of *Catillaria* belonging to the *C. athallina*-group of Kiliias, the ascus tips were *Bacidia*-type, not *Catillaria*-type, and he therefore created a new genus, *Kiliasia*, to accommodate these species, including *C. tristis*. When Timdal (1991) synonymized *Kiliasia* within *Toninia*, he did not include *K. tristis* because some characters did not fit those of *Toninia* perfectly. Hafellner and Türk (2016) later concluded that the species should nevertheless be included in *Toninia*. To do so, they had to select the next older name at the species level, *Catillaria subnitida* Müll. Arg., from a list of its synonyms because the name *Toninia tristis* (Th. Fr.) Th. Fr., pertains to an entirely different lichen, precluding the use of another “*tristis*” in that genus. Recent molecular studies by Kistenich *et al.* (2018), however, show the phylogenetic distinctness of *Toninia athallina* (Hepp) Timdal, the type species of *Kiliasia*, and some related species. Although *K. tristis* was not included in their analyses, its similarity to *K. athallina* led those authors to include *K. tristis* in the resurrected *Kiliasia*.

The Ottawa specimen agrees in all respects with the description of *C. tristis* in Kiliias (1981). It has a thin, dark, areolate thallus with flat, black apothecia, 0.3–0.6 mm in diameter, having prominent but thin margins. The spores are two-celled, (7.6–)9.5–11.4 × 3.6–4.6(–5.2) µm, colourless, and thin walled, but it is the exciple/hypothecium that sets it apart from superficially similar lichens. These tissues are red-black in the centre, becoming paler purplish or greenish to almost colourless at the outer edges. The pigmented parts turn purple with KOH or nitric acid; the epiphygium is greenish. It is a rare north temperate lichen in North America. CNALH (2019) (sub *Toninia subnitida*) has unverified records from British Columbia, Michigan, and Minnesota, and the species appears to be new for Ontario. It grows only on calcareous rock.

- Lathagrium undulatum* (Flot.) Otálora, P.M. Jørg. & Wedin var. *granulosum* (Degel.) M. Schultz & McCune. ON: Burnt Lands Provincial Park, on limestone, *Lewis 2305*.
- Lecania fuscella* (Schaer.) Körb. ON: Bells Corners, Stony Swamp (MCSA), on fallen crown of *P. balsamifera*, *Lee 1411*.
- Lecania naegelii* (Hepp) Diederich & Van den Boom. QU: Chelsea, on dead branch, *Freebury 2243*.

- Lecanora appalachensis* Lendemer & R.C. Harris. QU: Gatineau Park, Faris Creek, on *Tilia*, *Lendemer 28351* (NY).
- Lecanora meridionalis* H. Magn. ON: Bells Corners, *Brodo 33664*. QU: Gatineau Park, Lac la Pêche, *Brodo 33870*.
- Lecanora perplexa* Brodo. ON: Navan, Macoun (?). QU: Mayo, *Brodo 23585*.
- Lecidea plebeja* Nyl. QU: Aylmer, base of cedar stump, *Brodo 29774*.
- Lecidella elaeochroma* (Ach.) M. Choisy. QU: Gatineau Park, Heney Lake, on Sugar Maple, *Hanes s.n.*, CANL 96178.
- Lecidella euphorea* (Flörke) Hertel. ON: Kemptville, on fence post, *Wong 1285*.
- Lepraria cryophila* Lendemer. QU: Gatineau Park, Trail 5, on under side of over-hanging rock, *Freebury 1450*, det. Lendemer.
- Lepraria eburnea* J.R. Laundon. ON: Bells Corners, Stony Swamp (MCSA), on *Thuja*, *Lendemer 28108* (NY).
- Lepraria elobata* Tønsberg. ON: Bells Corners, Stony Swamp (MCSA), on rock, *Lendemer 28160* (NY). QU: Gatineau Park, Church Hill, on *P. strobus* base, *Lendemer 28349-A* (NY), det. Lendemer.
- Lepraria harrisiana* Lendemer. ON: Bells Corners, Stony Swamp (MCSA), on *Thuja*, *Lendemer 28152* (NY). This recently described species (Lendemer 2013) is similar to *Lepraria caesiella* R.C. Harris in chemistry (atranorin, pallidic acid, and zeorin), but the soredia (“ecorticate granules” as used by Lendemer 2013) that make up the major part of the thallus lie on a white hypothallus, like a bed of white hyphae, visible between clumps of soredia or at the thallus margins.
- Lepraria humida* Slav.-Bayr. & Orange. QU: Gatineau Park, near Asticou, Trail 5, on shaded siliceous rock, *Freebury 2269*, det. Lendemer. This is a species of shaded rock walls and overhangs (Lendemer 2013). The soredia typically occur in dispersed patches, although they can coalesce in places into a continuous crust. It contains atranorin, rangiformic, and norrangiformic acids, lacking zeorin.
- Lepraria normandinoides* Lendemer & R.C. Harris. QU: Gatineau Park, near Hickory Trail, on rock face, *Brodo 32683*.
- Lepraria oxybapha* Lendemer. QU: Gatineau Park, near Eardley in waterfall area, on rocks at falls, *Brodo 16844*, with *L. Dickson* and *C. Jutras*, det. Lendemer. In this dust lichen, the soredia coalesce into small lobes often with thicker rims. Its chemistry, atranorin, fumarprotocetraric acid (PD+ red), and roccellic acid, makes it especially distinctive. It closely resembles *L. normandinoides*, which

- contains protocetraric rather than fumarprotocetraric acid and tends to be bluish grey rather than yellowish, as in *L. oxybapha*. The latter is an eastern North American, especially Appalachian, endemic (Lendemer 2013).
- Leprocaulon adhaerens* (K. Knudsen, Elix & Lendemer) Lendemer & B.P. Hodk. (syn. *Lepraria adhaerens* K. Knudsen, Elix & Lendemer). QU: Chelsea, on granitic rock in forest, *Brodo 32431B*, det. Lendemer; Gatineau Park, Faris Creek, on sheltered rock, *Lendemer 28376* (NY), with *C. Freebury*, det. Lendemer. First described as a species of *Lepraria*, this lichen was transferred to *Leprocaulon* by Lendemer and Hodkinson (2013). This and most other species of *Lepraria* and *Leprocaulon* are difficult if not impossible to identify reliably without recourse to thin layer chromatography or other methods for revealing the chemical products. *Leprocaulon adhaerens* is described and discussed in Knudsen *et al.* (2007), which is available online. It was described from California but is also known from eastern United States (Knudsen *et al.* 2007). Its chemistry is unusual among species of *Lepraria* or *Leprocaulon*, containing the PD+ orange substance pannarin, as well as zeorin. The leprose, bluish-grey thallus grows over bryophytes and sometimes soil and rocks (Lendemer 2013). This is a first report for Canada and Quebec.
- **Marchandiomyces corallinus* (Roberge) Diederich & D. Hawksw. QU: Aylmer, parasitizing *Physcia* cfr. *stellaris* (L.) Nyl., *Freebury 2304*.
- **Merismatium peregrinum* (Flot.) Triebel. QU: Gatineau Park, Church Hill, on rock, on thallus of *Rimularia badioatra* (Kremp.) Hertel & Rambold, *Lendemer 28336-A* (NY). This species, reported from Pennsylvania as new to North America by Harris and Lendemer (2005), is a pyrenomycete parasite apparently restricted to *R. badioatra* (also reported below as new to the Ottawa region). Hertel and Rambold (1990) describe it as having (2-)4-celled, rather dark brown spores, (12-)14-16(-17) × 4.5-7 µm. It is a new record for Canada.
- +*Microcalicium ahneri* Tibell. QC: Gatineau Park, Keogan Cabin, lignicolous, *McMullin 18780*.
- Multi clavula mucida* (Fr.) R.H. Peterson. ON: Gloucester, on cedar log, *Wong 4523*. QU: Gatineau Park, Black Lake, on rotting log near boggy area, *Brodo 31783*.
- Mycobilimbia epixanthoides* (Nyl.) Vitik., Ahti, Kuusinen, Lommi & T. Ulvinen. ON: Bells Corners, Stony Swamp (MCSA), on *Thuja*, *Lendemer 28145* (NY).
- Mycoblastus caesius* (Coppins & P. James) Tønsberg. QU: Chelsea; on fallen *A. saccharum*, *Brodo 32408*.
- Nephroma helveticum* Ach. var. *helveticum*. QU: Gatineau Park, Trail 5, Asticou, on mossy rock, *Freebury 20*.
- Ochrolechia mexicana* Vain. QU: Gatineau Park, Booth picnic field, Kingsmere, on *A. saccharum*, *Bégin-Robitaille s.n.*, "4/11/1975."
- Parmeliella triptophylla* (Ach.) Müll. Arg. QU: Gatineau Park, Trail 5, Asticou, on base of *Quercus*, *Brodo 32682*.
- Parmeliopsis capitata* R.C. Harris ex J.W. Hinds & P.L. Hinds. QU: Gatineau Park, Lac Ramsay, on Black Spruce (*Picea mariana* (Miller) Britton, Sterns & Poggenburgh) in bog, *Brodo 13345*.
- Parmotrema subtinctorium* (Zahlbr.) Hale (= *Parmelia crinita* Ach. f. *varians* G. Merr.; ≡ *Canomaculina subtinctoria* (Zahlbr.) Elix). The voucher specimen cited here is the holotype of *Parmelia crinita* f. *varians* G. Merr. described in 1908 in a rarely cited paper on species of *Parmelia s. lat.* found at that time in CANL (Merrill 1908). The only other species of *Parmotrema* in the Ottawa region is *Parmotrema crinitum* (Ach.) M. Choisy, rather rare and confined to humid habitats such as old cedar swamps. *Parmotrema subtinctorium* is even rarer, having been found only twice in southern Ontario by John Macoun (Wong and Brodo 1992) and more typical of southeastern United States (Brodo *et al.* 2001, sub *Canomaculina subtinctoria*). It has not been found since and may well be extirpated in Canada. It somewhat resembles *P. crinitum* but has a pale lower surface without the naked margin characteristic of most species of *Parmotrema*, and the isidia do not sprout black cilia as do the isidia of *P. crinitum*. In addition, the voucher contains salazinic acid and norlobaridone rather than stictic acid.
- Peltigera extenuata* (Nyl. ex Vain.) Lojka. ON: Ottawa, southeast of Ottawa airport, over moss, *Freebury 2299*. QU: Gatineau Park, Ramsey Lake, on soil on rock ledges near lake, *Brodo 16795*.
- Peltigera ponojensis* Gyeln. ON: Bells Corners, on vertical surface of exposed boulder near swamp, *Brodo 13322B*, det. Goward. QU: Gatineau Park, Lac Meech, MacDonald Bay, on soil, *Brodo 25009*.
- Pertusaria globularis* (Ach.) Tuck. QU: Gatineau Park, King Mountain, on siliceous rock, *Freebury 261*, det. Brodo. There are four collections from Gatineau Park, all of them isidiate, thereby distinguishing them from the recently described *Pertusaria superiana* Lendemer & E. Tripp, which

- is similar but lacks isidia (Tripp and Lendemer 2019). The latter is cited from two localities in southern Ontario (Tripp and Lendemer 2019).
- +*Phaeocalicium minutissimum* (G. Merr.) Selva. ON: Bells Corners, Stony Swamp (MCSA), on bark of 10-cm diameter *Q. rubra*, Lee 2424. QU: Gatineau Park, King Mountain, on *Q. rubra* saplings, Brodo 30422, det. Selva.
- +*Phaeocalicium polyporaenum* (Nyl.) Tibell. ON: Gloucester, Leitrim, on “*Polyporus*”, Brodo 30427. QU: Chelsea, on *Tricaptum* sp. (polypore), Brodo 32411.
- +*Phaeocalicium populneum* (Brond. ex Duby) A.F.W. Schmidt. QU: Gatineau Park, Luskville Falls Trail, on *Populus*, McMullin 18775.
- Phaeophyscia orbicularis* (Neck.) Moberg. ON: Bel-Air Heights, on a deciduous shrub, McMullin 18812. QU: Gatineau Park, Pink Lake, on Scotch Elm (*Ulmus glabra* Hudson), Goward 82-91 (UBC).
- Phlyctis speirea* G. Merr. s. str. ON: Bells Corners, Stony Swamp, on *Thuja*, Lendemer 28118 (NY). QU: Gatineau Park, between Lac Ramsay and Lac Hawley, on *T. occidentalis*, Brodo 16309. We are using this name in the strict sense to refer to specimens that are fertile (i.e., with apothecia) containing asci, each having a single, large, muriform spore (see Muscavitch *et al.* 2017).
- Physcia tenella* (Scop.) DC. ON: Bells Corners, on north side of West Hunt Club Road just east of Moodie Drive, on deciduous tree, Brodo 33104.
- Physciella melanchra* (Hue) Essl. ON: Ottawa, McLeod Street, on roadside tree, Brodo 33113. QU: Gatineau Park, Luskville Falls parking lot area, on deciduous tree, Brodo 32141 with *Freebury*.
- Physconia leucoleiptes* (Tuck.) Essl. ON: North Gower, on dead *Fraxinus*, Brodo 22767, det. Esslinger. QU: Poltimore, on limestone cliff, Brodo 19167, det. Esslinger.
- Placidium squamulosum* (Ach.) Breuss. ON: Burnt Lands alvar, 3.73 km north of Almonte, on soil, Brodo 32619. QU: Pontiac, Bristol, on soil in open, Brodo 29711.
- Placynthium flabellousum* (Tuck.) Zahlbr. QU: Gatineau Park, Luskville Falls, on streamside rock, Brodo 29696.
- Placynthium stenophyllum* (Tuck.) Fink var. *isidiatum* Henssen. ON: Burnt Lands Provincial Park, on limestone, Lewis 2310.
- Porpidia contraponenda* (Arnold) Hertel & Knoph (syn. *P. diversa* (Lowe) Gowan). QU: Papineau Co., 3.5 miles [5.6 km] north of Mayo, on granitic boulder, Brodo 23578, det. Gowan.
- Porpidia soredizodes* (Lamy ex Nyl.) J.R. Laundon. ON: Blakeney, on vertical rock wall near stream, Brodo 29907, det. Lendemer. QU: Gatineau Park, Church Hill, on rock, Lendemer 28339 (NY), det. Lendemer.
- Prototremella hypotremella* Herk, Spier & V. Wirth. ON: North Gower, on sunny *A. balsamea*, parasitized by *Sphinctrina anglica* Nyl., Brodo 22761B.
- Psilolechia lucida* (Ach.) M. Choisy. ON: Fitzroy Harbour, on overhang by river, Brodo 33160. QU: Gatineau Park, Lac la Pêche, on rock wall near lake, Brodo 31815.
- Psora decipiens* (Hedw.) Hoffm. ON: Burnt Lands Provincial Park, on soil, Brodo 32623; on calcareous soil, Lewis 2277; Panmure Alvar, Timmins Road, on calcareous soil, Lewis 2236a.
- Punctelia caseana* Lendemer & B.P. Hodk. ON: Bells Corners, Stony Swamp (MCSA), on *Thuja*, Lendemer 28150 (NY). QU: Luskville, Gibson Road, escarpment, on *Q. rubra*, Freebury 630.
- Pyrenula micheneri* R.C. Harris. ON: Ottawa, on Blue-beech (*Carpinus caroliniana* Walter), Macoun, 1893 (US) (Harris 1989). Unlike *Pyrenula pseudobufonia* (Rehm) R.C. Harris, which is the common *Pyrenula* in the Ottawa region, the thallus of *P. micheneri* does not fluoresce yellow with long-wave ultraviolet (UV) light, and the spores have thickened walls at the tips. When he described the species, Harris (1989) had only seen collections made before 1900 and believed it may already have been extinct. However, since then, he found it in the Ozark Mountain region (Harris and Ladd 2005) and North Carolina (CNALH 2020). It may, however, no longer be present in the Ottawa region.
- Rhizocarpon badioatrum* (Flörke ex Spreng.) Th. Fr. QU: Luskville, Gibson Road, escarpment, on acidic rock, Freebury 641, ver. Brodo.
- Rhizocarpon timdalii* Ihlen & Fryday. ON: Carp, Carp Hills, on exposed granite, Brodo 24924. This grey-brown map lichen was known only from northeastern United States and Europe (Ihlen and Fryday 2002) until it was recently reported from Sandbar Lake Provincial Park in northwestern Ontario's Kenora District by Dorval and McMullin (2020), the first report from Ontario and Canada. There are also specimens from Algoma District and Renfrew County in CANL; thus, the species probably has a wide hemi-boreal distribution.
- Rimularia badioatra* (Kremp.) Hertel & Rambold. QU: Gatineau Park, Church Hill, on rock, Lendemer 28336 (NY), det. Lendemer. This Appalachian species is a first record for Quebec. It is also known from New Brunswick (CNALH 2019) as a result of collections made during the 2011

- Tuckerman Workshop in the southeastern corner of that province. It has a thin, pinkish brown, areolate crust with immersed black apothecia containing broadly ellipsoid 1-celled spores, 10–17 × 7–10 μm (*vide* Giavarini and David 2009). The medulla of the thallus contains gyrophoric acid and turns pink when tested with bleach (C+ pink).
- Rinodina fimbriata* Körb. QU: Gatineau Park, Eardley, on rocks at edge of stream, *Brodo 16855* (Sheard 2010). *Rinodina fimbriata* is a saxicolous species growing on rock usually close to water. Its apothecia are immersed in the thallus like an *Aspicilia*, but it has large, brown, two-celled spores with hourglass-shaped lumina (*Mischoblastia*-type), ~19–24 × 10–14 μm, becoming somewhat inflated at the septum when the spores are old (Sheard 2010). It is quite rare in North America, and the specimens cited above were the only known Canadian records until it was recently found in Algonquin Provincial Park (*Lewis 366* [CANL]), a new record for Ontario.
- Rinodina oxydata* (A. Massal.) A. Massal. ON: Ottawa, Rockcliffe Park, on limestone ledges, river shore, *Brodo 22777*, det. Sheard. QU: Mayo, mixed hardwood stand, on rock, *Brodo 23592*.
- Rinodina pachysperma* H. Magn. ON: Ottawa, Britannia, on *A. rubrum*, *Macoun 357*, det. Sheard. QU: Gatineau Park, Luskville Falls, on bark, *Sheard 1431a*.
- Rinodina siouxiana* Sheard. ON: Blakeney, on vertical rock wall, *Brodo 29902*. QU: Gatineau Park, Chemin de la Montagne, base of King Mountain, siliceous rock in forest, *Brodo 32694*.
- Rinodina subpariata* (Nyl.) Zahlbr. (syn. *R. degeliana* Coppins). ON: Gloucester, on maple, *Wong 4525*. QU: Gatineau Park, east side of Beaver Canal, on Sugar Maple, *Hanes s.n.*, 2 April 1972, det. Lendemer.
- Ropalospora chlorantha* (Tuck.) S. Ekman. QU: Poltimore, on *A. rubrum*, *Brodo 27645*.
- Ropalospora viridis* (Tønsgberg) Tønsgberg. ON: Fitzroy Harbour, on deciduous tree bark, *Brodo 33171*. QU: Aylmer, on *A. rubrum*, *Brodo 28913*.
- Rusavskia sorediata* (Vain.) S.Y. Kondr. & Kärnefelt (syn. *Xanthoria sorediata* (Vain.) Poelt). ON: Bells Corners, Stony Swamp (MCSA), on non-limy sandstone boulder in old field, *Lee 1410*.
- +*Sarea difformis* (Fr.) Fr. QU: Aylmer, CMN campus, resinicolous on *P. strobus*, *McMullin 21099*. See comments under *Sarea resiniae* (Fr.) Kuntze.
- +*Sarea resiniae* (Fr.) Kuntze. ON: Bells Corners, Stony Swamp (MCSA), on hardened Balsam Fir gum, *Lee 229*; Stony Swamp, on *Abies exudate*, *Lendemer 28136* (NY). QU: Gatineau Park, Lac Philippe, north shore, on *T. occidentalis* resin, *Brodo 24930*; Keogan Lodge, on *P. strobus* resin, *McMullin 18781*. *Sarea* is a genus of unlichenized fungi that grow on the old, hardened resin of conifer trees. It has recently been classified in its own class, order, and family (Sareomycetes, Sareales, Sareaceae) as the result of molecular studies (Beimforde *et al.* 2020). These results are surprising because species of *Sarea* resemble some lichen fungi and even some lichens such as *Biatorrella*, having club-shaped asci containing more than 100 globose, colourless spores, 2–3.5 μm in diameter. The apothecia of *S. resiniae* are orange-brown, and those of *S. difformis*, a much rarer species, are black.
- Scytinium schraderi* (Bernh.) Otálora, P.M. Jørg. & Wedin (syn. *Leptogium schraderi* (Bernh.) Nyl.). ON: Burnt Lands Provincial Park alvar, on rock, *Lewis 2316b*. This small *Scytinium* species is found growing on calcareous rock in alvars. It is a misunderstood species that can be confused with another *Scytinium* species, *Scytinium turgidum* (Ach.) Otálora, P.M. Jørg. & Wedin, which can be found growing in similar habitats (Jørgensen 1994). The material examined here matches well with the description of *S. schraderi* having a thallus consisting of cylindrical, glossy brown lobes or branches that have a distinctly wrinkled upper surface when dry (Jørgensen 2007; Gilbert and Jørgensen 2009). This species looks like a robust *Scytinium teretiusculum* (Dickson) Otálora, P.M. Jørg. & Wedin, but with wrinkled, furrowed branches rather than smooth branches, more like a subfruticose form of *Scytinium lichenoides* (L.) Otálora, P.M. Jørg. & Wedin. It grows on limestone (see discussion under *S. subtile*, next entry). *Scytinium schraderi* was recently reported as new to Ontario from Frontenac Provincial Park by Lewis (2020) and again by Brinker (2020), with a colour photograph, from several localities in southern Ontario.
- Scytinium subtile* (Schrader) Otálora, P.M. Jørg. & Wedin (syn. *Leptogium subtile* (Schrader) Torss.). ON: Bells Corners, Stony Swamp (MCSA), on basal bark of *Fraxinus* in small swamp, *Lee 2423*. This species has already been reported from the Ottawa region by Lewis and Brinker (2017). It belongs to a group of species together with *S. schraderi*, *Scytinium tenuissimum* (next entry), and *Scytinium teretiusculum* (two entries below) all of which form tiny, subfruticose clumps and are often very difficult to distinguish. *Scytinium subtile* is the smallest, forming nothing more than tiny rosettes of squamules finely divided at the margins, surrounding a few convex, orange-brown apothecia under 0.5 mm in diameter, the entire rosettes

- usually under 2 mm in diameter. *Scytinium tenuissimum* is also fertile, but not forming rosettes and with larger, flat apothecia and a few distinct lobes that develop isidia-like margins. *Scytinium teretiusculum* is rarely fertile and usually consists entirely of long, cylindrical, isidia-like branches, forming tufts a few millimetres in diameter. *Scytinium schraderi*, until recently known only from western North America, differs from all these in having distinctly wrinkled and furrowed branches, more closely resembling subfruticose forms of *S. lichenoides*. In the latter species, the isidia can almost always be seen to be arising from broader, wrinkled lobes, something lacking in *S. schraderi*.
- Scytinium tenuissimum* (Dickson) Otálora, P.M. Jørg. & Wedin (syn. *Leptogium tenuissimum* (Dickson) Körb.). ON: Bells Corners, Stony Swamp (MCSA), on basal bark of *Fraxinus* at edge of swamp, *Lee 1343*.
- Scytinium teretiusculum* (Wallr.) Otálora, P.M. Jørg. & Wedin (syn. *Leptogium teretiusculum* (Wallr.) Arnold). ON: South Gloucester, on base of *Tilia*, edge of wet woods in shade, *Brodo 25501*.
- Steinia geophana* (Nyl.) Stein. ON: Ottawa, near Mer Bleu, on sandy soil under hydroelectric pylon, *Brodo 30300*. QU: Aylmer, on decaying vegetation and soil, *Brodo 30302A*. This very inconspicuous crustose lichen with a membranous thallus and tiny, brown, biatorine apothecia has thin-walled asci that contain (12–)16 colourless, globose, or almost globose ascospores, (3.3–)5.0–6.4 × 3.6–6.4 µm in the Ottawa material. It grows on poor, consolidated, metal-rich soil, often under hydroelectric pylons, and is associated with species of *Veizdaea* (see notes below under that genus; Brodo 2001).
- +*Stenocybe major* Nyl. ex Körb. ON: Bells Corners, Stony Swamp (MCSA), on bark of 10-cm-diameter *A. balsamea*, *Lee 2425*.
- +*Stenocybe pullatula* (Ach.) Stein. ON: Bells Corners, Stony Swamp (MCSA), on alder (*Alnus*) bark, *Lee 1894*.
- Stereocaulon condensatum* Hoffm. QU: Gatineau Park, Lac Ramsay, on sandy soil in abandoned picnic area, *Freebury 165*, det. Brodo.
- Strangospora moriformis* (Ach.) Stein. ON: Bells Corners, Stony Swamp (MCSA), on small Black Ash (*Fraxinus nigra* Marshall) trunk in young *Thuja* swamp, *Lee 1880*.
- **Syzygospora physciacearum* Diederich. QU: Gatineau Park, Lac Ramsay, on sandy soil in abandoned picnic area, *Freebury 1416*, det. Diederich.
- Thelidium fontigenum* A. Massal. (syn. *T. microbolum* (Tuck.) Hasse). ON: Ottawa, Vincent Massey Park, on rocks along sandy beach beyond railroad bridge, *Brodo 29223*.
- Thelidium minutulum* Körb. ON: Burnt Lands Provincial Park, growing with *Bagliettoa calciseda* (DC.) Gueidan & Cl. Roux (see List III), *Brodo 32617*.
- Thermutis velutina* (Ach.) Flot. QU: Gatineau Park, Pink Lake, on shaded rock overhang, *Brodo 33219*.
- Trapelia obtegens* (Th. Fr.) Hertel. ON: Bells Corners, Stony Swamp (MCSA), on rock, *Lendemmer 28127* (NY). QU: Gatineau Park, Chelsea, granitic rock overlooking pond, *Brodo 32417*.
- Trapelia stipitata* Brodo & Lendemmer. ON, Blakeney, on partly shaded granite outcrop in woods, *Brodo 29875*. QU: Gatineau Park, Luskville Falls, on rock, *Brodo 21014*. (See Brodo and Lendemmer 2015.)
- Trapeliopsis flexuosa* (Fr.) Coppins & P. James. ON: Limoges, LaRose Forest, on dead pine branch, *Brodo 31810*. QU: Gatineau Park, Trail 53 near parking lot 17, on rotting log, *Freebury 254*, ver. Brodo.
- Trapeliopsis gelatinosa* (Flörke) Coppins & P. James. ON: South March, in open clearing, *Shchepanek 155b*. QU: Gatineau Park, Church Hill, on soil, *Freebury 1446*, det. Lendemmer.
- **Tremella christiansenii* Diederich. QU: Gatineau Park, parking area 17, on *Physcia aipolia*, *Freebury 1412*, det. Diederich. New to the North American checklist (Esslinger 2019).
- Tuckermannopsis orbata* (Nyl.) M.J. Lai. ON: Burnt Lands Provincial Park, on Jack Pine (*Pinus banksiana* Lambert), *Lewis 2333*. QU: Gatineau Park, Lac Ste-Marie, on dead cedar, *Hanes s.n.*, CANL 96152.
- Verrucaria viridula* (Schrader) Ach. [cf.]. QU: Gatineau Park, Lac Ramsay, on siliceous rock (normally on HCl+ rock), *Brodo 16828*.
- Veizdaea acicularis* Coppins. QU: Aylmer, on sandy soil and moss shaded by Common Juniper (*Juniperus communis* L.), *Brodo 29865* (Brodo 2001).
- Veizdaea leprosa* (P. James) Vězda. ON: Ottawa (Gloucester), Anderson Road, on sandy soil, *Brodo 30299*. QU: Aylmer, on decaying vegetation and soil, *Brodo 30302A*, with *Steinia geophana* (Brodo 2001).
- Violella fucata* (Stirton) T. Sprib. (syn. *Mycoblastus fucatus* (Stirton) Zahlbr.). ON: Bells Corners, Stony Swamp (MCSA), on *Thuja* branch, *Lendemmer 28106* (NY); LaRose Forest, corticolous, *McMullin s.n.*
- Xanthomendoza hasseana* (Räsänen) Søchting, Kärnefelt & S.Y. Kondr. ON: Constance Lake area, on poplar, *Shchepanek 129*. QU: Gatineau

Park, Lac Ramsay, on *P. tremuloides*, Brodo 29505; Luskville Falls Trail, on *Populus*, McMullin 18758.

Xanthomendoza ulophyllodes (Räsänen) Søchting, Kärnefelt & S.Y. Kondr. ON: Manotick, on roadside poplar, Brodo 5630, det. Lindblom; Ottawa, Fisher Heights, on *Acer*, McMullin 20096. QU: Gatineau Park, Trail 5, near Asticou, on shaded acidic rock, Freebury 219, det. Brodo.

Xanthoria parietina (L.) Th. Fr. ON: Ottawa, Mooney's Bay, on bark of transplanted deciduous tree, Freebury 2554; Fisher Heights, on *Acer*, McMullin 20097. QU: Aylmer, Rue du Conservatoire, south of chemin Pink, on planted maple, Brodo and Freebury [sight record].

II. New records based on re-identifications of Ottawa specimens of species in Brodo (1988) list (i.e., not synonyms)

Bellemeria cinereorufescens (Ach.) Clauzade & Cl. Roux (= *Bellemeria* sp. in Brodo (1988)). ON: Renfrew Co., Mackie Creek, near Calabogie, on rock, partly shaded, Brodo 27914. QU: Gatineau Park, between Ramsay Lake and Holly Lake, on siliceous rock, Brodo 29502; Poltimore, on stone in shaded pasture glade, Brodo 19179.

Biatora pycnidia Printzen & Tønsberg (= some specimens of *Lecidea helvola* (Körb. ex Hellb.) H. Olivier). QU: 7.5 km west of Poltimore, stand of Sugar Maple, on ash (*Fraxinus*) in stream area, Brodo 24965, det. C. Printzen. The PD+ red reaction in the thallus due to argopsin is sometimes hard to demonstrate because the thallus is thin and membranous to rimose-areolate, but it was seen in the voucher. The specimen, however, had smaller ascospores than usual: 9–11 × 2.3–2.5 µm versus (8.5–)12.5–15(–19) × 3.0–4.5(–5.5) µm in Brodo (2016).

Cladonia ignatii Ahti, Pino-Bodas & J.W. McCarthy (= specimens of *Cladonia ramulosa* (With.) J.R. Laundon). ON: Bells Corners (MCSA), Brodo 32901, det. J. Lendemer. QU: Gatineau Park, Lac Meech, on an island in MacDonald Bay, on top surface of log (*Thuja*) on clearing near lake shore, Brodo 25005. Ahti et al. (2018) recently described this species, segregated from the very similar *C. ramulosa* by having ecorticate, granulose to microsquamulose, cupless podetia (versus verrucose-corticate, granular, sometimes cupped), and small, very finely divided, coarsely granular-sorediate primary squamules that form an almost granulose crust (versus large, deeply lobed, largely esorediate primary squamules that remain well-defined). On re-examination, the material identified as *C.*

ramulosa from the Ottawa region proved to be *C. ignatii*, confirming the suspicion of Ahti et al. (2018) that the species is probably widespread in the northern part of the East Temperate region (see Brodo et al. 2001), from Iowa to Newfoundland.

Endocarpon pallidulum (Nyl.) Nyl. (= specimens of *Endocarpon pusillum* Hedwig). ON: Rockcliffe Park, on limestone on river shore, Brodo 22797; North Gower, on shaded limestone, Brodo 22731. QU: Gatineau Park, base of King Mountain, on top of cliff, Brodo 18811.

Eopyrenula intermedia Coppins (= specimens of *Eopyrenula leucoplaca* (Wallr.) R.C. Harris). ON: Ottawa, "near Hintonburgh" [sic], on maple trees, Macoun, 18 April 1806. QU: Near Hull, on maple bark, Macoun 3247. This species may no longer be present in the region, although it is easily overlooked.

Lecania croatica (Zahlbr.) Kotlov (= "*Lecidea* sp. #4 sensu Harris"). ON: Bells Corners, Stony Swamp, on *Fraxinus*, Lendemer 28117 (NY). QU: Aylmer, base of *Fraxinus*, Brodo 29772, with P.Y. Wong.

Lempholemma chalazanum (Ach.) B. de Lesd. (= specimens of *Lempholemma* sp.). ON: Rockcliffe Park, base of limestone cliff at river's edge, Brodo 22801 with Wong and Darbyshire. QU: Aylmer, on soil, under hydro pylon, Brodo 30705. Apparently new for Ontario and Quebec.

Lepraria caesiella R.C. Harris (= some of the specimens of *Lepraria incana* (L.) Ach.). ON: Fitzroy Harbour, on *P. strobus*, partly shaded, Brodo 33183. QU: Gatineau Park, Church Hill, on *Tsuga*, Lendemer 28332 (NY); Keogan Lodge, on *Pinus*, McMullin 18785. This species contains atranorin, zeorin, and a fatty acid and is, therefore, UV negative. *Lepraria incana* is an exclusively European lichen (Lendemer 2013). *Lepraria hodkinsoniana* Lendemer is also very similar and has been found just west of the limits of the Ottawa region in the White Lake area. It contains divaricatic acid in addition to zeorin and sometimes atranorin and is blue-white under long-wave UV light (Lendemer 2013).

Leptogium rivulare (Ach.) Mont. (= specimens of *Leptogium juniperinum* Tuck.), Flooded Jellyskin. ON: Bells Corners, Stony Swamp, on base of *Fraxinus*, Brodo 18746. QU: Aylmer, Boucher Forest, on Green Ash (*Fraxinus pennsylvanica* Marshall), James Pagé ST82, with Shaun Thompson (CANL). Flooded Jellyskin was thought to be extremely rare but has recently been found more frequently in its preferred habitats: vernal ponds in hardwood forests on the bases of *Fraxinus* and *Acer*, and, more rarely, on periodically flooded rocks (Environment Canada 2013). It is almost

always fertile and its asci are consistently four-spored. It was first listed as Threatened under the federal *Species at Risk Act* (SARA) in 2005. In 2019, it was reassessed as Special Concern (SARA Registry 2021a) based on COSEWIC (2015).

Naetocymba punctiformis (Pers.) R.C. Harris (= specimens of *Arthopyrenia epidermidis* (DC.) A. Massal. ≡ *Arthopyrenia punctiformis* (Pers.) A. Massal.). ON: Ottawa, along Rideau River near Hogs Back, *Macoun 148*, det. R.C. Harris.

Phaeophyscia decolor (Kashiw.) Essl. (= specimens of *Phaeophyscia endococcina* (Körb.) Moberg). ON: Bells Corners, Stony Swamp (MCSA), on limy sandstone, *Lee 1402*. QU: Gatineau Park, King Mountain area off Mountain Road, on limestone on cliff-top, *Brodo 18826*.

Phaeophyscia squarrosa Kashiwadani (includes *Phaeophyscia imbricata* (Vain.) Essl. sensu Esslinger 1978). QU: Gatineau Park, King Mountain off Mountain Road, on marble, *Brodo 21193*.

Physcia thomsoniana Essl. (= specimens of *Physcia subtilis* Degel.). ON: Carp Hills, on acidic rock, *Freebury 2294*. QU: Gatineau Park, Luskville Falls, saxicolous (non-calcareous), *McMullin 18771*; Gatineau Park, Faris Creek, on siliceous rock, *Freebury 188*, det. Brodo. This saxicolous species was recently segregated from the similar *P. subtilis* by Esslinger (2017). It is more common than *P. subtilis* and has larger lobes and a distinct, webby (hyphal) medulla. *Physcia thomsoniana* is less closely appressed to the rock substrate than *P. subtilis* and can, therefore, be easily removed from it; *P. subtilis* must be collected together with the substrate to get more than fragments. Based on the distribution maps in Esslinger (2017), it is likely that all specimens identified as *P. subtilis* from the Ottawa region should be referred to this new species, but this study has yet to be completed. Furthermore, because Esslinger (2017) states that the very similar *Physcia millegrana* Degel. is strictly corticolous, some or all of the many saxicolous records of the latter species in CANL may also represent *P. thomsoniana*. This also has to be explored.

Physconia subpallida Essl. (Figure 2; see McMullin *et al.* [2016] for additional images), Pale-bellied Frost Lichen (= specimens of *Physconia distorta* (With.) J.R. Laundon). ON: Ottawa, on trees, *Macoun*, 1891, CANL 19058, det. Werier and Cleavitt. QU: Gatineau Park, King Mountain summit area, on White Oak (*Quercus alba* L.) and Eastern Hop-hornbeam (*Ostrya virginiana* (Miller) K. Koch), *McMullin*, sight record.

Porpidia subsimplex (H. Magn.) Fryday (= specimens of *Porpidia cinereoatra* (Ach.) Hertel & Knopf).

ON: Blakeney, on boulder in woods, *Brodo 29867*. QU: Gatineau Park, Luskville Falls, on siliceous rock, *Brodo 21017*.

Rhizocarpon infernum (Nyl.) Lynge f. *sylvaticum* Fryday (= specimens of *Rhizocarpon hochstetteri* (Körb.) Vain.). QU: Gatineau Park, Lac la Pêche, on shaded rock in forest, *Brodo 16381*.

Rhizoplaca subdiscrepans (Nyl.) R. Sant. (= specimens of *Rhizocarpon chrysoleuca*). ON, Bells Corners, on partly exposed boulder in glade, *Brodo 13316*. QU: Gatineau Park, Luskville Falls, on siliceous rock, *Brodo 5583*.

Rinodina moziana (Nyl.) Zahlbr. (syn. *Rinodina destituta* (Nyl.) Zahlbr.) (= specimens named as *Rinodina iowensis* Zahlbr., *Rinodina cana* (Arnold) Arnold, or *Rinodina verrucosa* ined.; see Sheard [2010: 83]). ON: Blakeney, on rock near stream, *Brodo 29893*. Sheard (2018) recently discussed this species and its synonymy. It is closely related to *R. oxydata*, also known from the region.

Rhizoplaca weberi (Ryan) Leavitt, Zhao Xin & Lumbsch (syn. *Lecanora weberi* Ryan) (= specimens of *Lecanora chlorophaeodes* Nyl.). ON: Carp Hills, Thomas Dolan Parkway, on acidic rock, *Freebury 1454*. QU: Gatineau Park, Renaud Ridge, on exposed siliceous rock, *Freebury 705*, det. Brodo.

Sarcogyne wheeleri K. Knudsen, J.H. Adams, Kocourk. & Y. Wang (= specimens of *Acarospora glaucocarpa* (Wahlenb. ex Ach.) Körb.). ON: Constance Lake, on exposed rock in mixed woodlot, *Shchepanek 10*. QU: Gatineau Park, Meech Lake, on an island in MacDonald Bay, on limestone, *I. Brodo 25700B*, with *F. Brodo*. New molecular studies of the phylogeny of *Acarospora* and *Sarcogyne* by Knudsen *et al.* (2020) have resulted in a surprising reclassification of both *Acarospora glaucocarpa* s. lat. and the closely related *Acarospora canadensis* H. Magn., placing them both into the genus *Sarcogyne*, a genus in which most species have a black, carbonaceous exciple. Furthermore, the North American specimens usually identified as *A. glaucocarpa* represent a separate species, which was named *S. wheeleri* (Knudsen *et al.* 2020).

Thyrea confusa Henssen (= specimens of *Thyrea pulvinata* (Schaer.) A. Massal.). ON: Burnt Lands alvar, on rock, *Brodo 32618A*.

Umbilicaria americana Poelt & T. Nash (= specimens of *Umbilicaria vellea* (L.) Ach.). QU: Gatineau Park, King Mountain, on acidic rock, *Freebury 625*.

Xanthoparmelia viriduloumbrina (Gyeln.) Lendemer (= specimens of *Xanthoparmelia somloënsis* (Gyeln.) Hale). ON: Bells Corners, Stony Swamp (MCSA),

on boulder in open field, *Wong & Nicholson 1866*, det. Wong. QU: Base of King Mountain, Hollow Glen Road, on mossy rock, *Freebury 1401*.

III. Species listed in Brodo (1988) that are new for either the Ontario or Quebec parts of the Ottawa region

Baeomyces rufus (Hudson) Rebert. QU: Gatineau Park, Eardley, Kidder Lake, on soil of roadbank, *Brodo 25959*. The species was included in the Ottawa list of Brodo (1988) based on sight records.

Bagliettoa calciseda (DC.) Gueidan & Cl. Roux (syn. *Verrucaria calciseda* DC.). ON: Ottawa, Vincent

Massey Park, on exposed limestone at river's edge, *Brodo 29227*.

Caloplaca microphyllina (Tuck.) Hasse. QU: Gatineau Park, Eardley and Bradley Roads, on wood, *Freebury 319*, ver. Brodo.

Caloplaca sideritis (Tuck.) Zahlbr. ON: Bells Corners, Stony Swamp (MCSA), on granite boulder, *Lee 1498*

Caloplaca ulmorum (Fink) Fink. ON: Bells Corners, Stony Swamp (MCSA), on *J. cinerea* branch, *Lee 1161*.

Candelariella aurella (Hoffm.) Zahlbr. QU: Gatineau Park, Luskville, Fire Tower, on concrete, *Freebury 195*.



FIGURE 2. Pale-bellied Frost Lichen, *Physconia subpallida*, a lichen listed as Endangered for both Ontario and Canada, recently found in the Ottawa region, Calabogie Peaks, Renfrew County, Ontario, March 2010. Photo: Chris Lewis.

- Candelariella efflorescens* R.C. Harris & Buck. ON: Bells Corners, Stony Swamp, on dead *Populus*, *Lendemer* 28141 (NY); Burnt Lands alvar, on deciduous shrub, *Brodo* 32616.
- Chaenotheca brunneola* (Ach.) Müll. Arg. ON: Gloucester, Leitrim wetlands, on ash stump in forest, *Brodo* 30425, with S. Selva and A. Dugal.
- Chaenotheca stemonea* (Ach.) Müll. Arg. ON: Bells Corners, Stony Swamp (MCSA), from rotted wood in old, sunken wound on Tamarack (*Larix laricina* (Du Roi) K. Koch) in old *Thuja* swamp, *Lee* 2238.
- Chrismofulvea dialyta* (Nyl.) Marbach. ON: Bells Corners, Stony Swamp (MCSA), on *J. cinerea* branch, *Lee* 226.
- Cladonia botrytes* (K. Hagen) Willd. QU: Kirk's Ferry near Meech Lake, on exposed log near swamp, *Brodo* 9639.
- Cladonia caespiticia* (Pers.) Flörke. QU: Gatineau Park, Lac Richard, base of *A. balsamea*, *Freebury* 383A, ver. Brodo.
- Cladonia magyrica* Vain. QU: Gatineau Park, Boulevard de la Cité-des-Jeunes, on exposed calcareous soil, *Freebury* 357.
- Cladonia parasitica* (Hoffm.) Hoffm. QU: Gatineau Park, Kidder Lake, on conifer log, *Freebury & Loesel* 129, ver. Brodo.
- Cladonia symphylicarpa* (Flörke) Fr. QU: Gatineau Park, Eardley-Masham Road, on thin soil, *Freebury* 160, ver. Brodo.
- Flavopunctelia flaventior* (Stirton) Hale. QU: Gatineau Park, Luskville Falls parking-picnic area, on *Acer*, *Brodo* 32140.
- Flavopunctelia soledica* (Nyl.) Hale. QU: Gatineau, off Vanier Road north of Pink Road, on Cherry (*Prunus*), *Brodo* 31782.
- Lecanora albella* (Pers.) Ach. ON: Bells Corners, Jackpine Trail, *Brodo* 33511.
- Melanohalea exasperatula* (Nyl.) O. Blanco *et al.* ON: Bells Corners, Stony Swamp (MCSA), on *A. balsamea* twig, *Lee* 1439.
- Micarea peliocarpa* (Anzi) Coppins & R. Sant. ON: Bells Corners, Stony Swamp, on *Thuja* log, *Lendemer* 28114 (NY).
- +*Mycocalicium subtile* (Pers.) Szat. ON: Bells Corners, Stony Swamp, on wood, *Lendemer* 28109 (NY).
- Myriolecis sambuci* (Pers.) Śliwa, Zhao Xin & Lumbsch. ON: Ottawa, Hog's Back Park, on *Populus*, *Freebury* 2191.
- Peltigera lepidophora* (Nyl. ex Vain.) Bitter. ON: Carp, Carp Hills, on thin soil over granitic outcrop, *Brodo* 24928.
- Pertusaria consocians* Dibben. ON: Bells Corners, Stony Swamp (MCSA), on trunk of old American Beech (*Fagus grandifolia* Ehrhart), *Lee* 1682.
- Physcia stellaris* (L.) Nyl. QU: Gatineau Park, Trail 5, Relais Plein Air, on *Ulmus*, *Freebury* 1132; Gatineau Park, Trail 53, on fallen willow (*Salix*), *Freebury* 1121.
- Physciella chloantha* (Ach.) Essl. QU: Lac Meech on an island in McDonald Bay, on limestone rock, *Brodo* 25007A, det. Brodo & Freebury.
- Protoblastenia rupestris* (Scop.) J. Steiner. QU: Pontiac County, Knox Landing sud, près de la pointe Ross, les alvars de la région du Lac des Chats, dallage calcaire fracturé et altéré, *Roy* 99-4387C (p.p., with *Catillaria lenticularis* (Ach.) Th. Fr.) (QFA).
- Psorotichia schaeereri* (A. Massal.) Arnold. ON: Burnt Lands Provincial Park, on limestone, *Lewis* 2316a.
- Ramalina intermedia* (Delise ex Nyl.) Nyl. ON: Ottawa (metro), near Fitzroy Harbour, on sandstone at river edge, *Brodo* 33168.
- Rinodina polyspora* Th. Fr. QU: Gatineau Park, Luskville, at Luskville Falls, on *Quercus*, *Sheard* 1428.
- Rinodina populicola* H. Magn. ON: Ottawa (Benson Street), *Brodo* 33856B.
- Rinodina subminuta* H. Magn. ON: South Gloucester, on *A. saccharum*, *Wong* 4368.
- Staurothele fissa* (Taylor) Zwackh. ON: Blakeney, on submerged rock, *Brodo* 29900.
- Strigula jamesii* (Swinscow) R.C. Harris. QU: Aylmer (NHC), on *Thuja*, *Lendemer* 28163 (NY).

IV. Summary of new records for North America, Canada, Ontario, and Quebec

New to the Checklist of North American lichens and lichenicolous fungi (Esslinger 2019): **Tremella christiansenii*.

New to Canada: *Caloplaca parvula*, *Caloplaca reptans*, *Cladonia petrophila*, *Enchylium tenax* var. *ceranoides*, *Leprocaulon adhaerens*, *Merismatium peregrinum*.

New for Ontario: *Caloplaca reptans*, *Kiliasia tristis*, *Lempholemma chalazanum*. Also *Rinodina fimbriata*, Ontario record, but not from Ottawa region (see entry in List I).

New for Quebec: *Arthonia helvola*, +*Arthonia hypobela*, *Caloplaca parvula*, *Cladonia petrophila*, *Lempholemma chalazanum*, *Leprocaulon adhaerens*, **Merismatium peregrinum*, *Rimularia badioatra*, **Tremella christiansenii*.

V. Name Changes

Name in Brodo (1988)

Accepted name

<i>Acarospora canadensis</i> H. Magn.	<i>Sarcogyne canadensis</i> (H. Magn.) K. Knudsen J.H. Adams, Kocourk. & Y. Wang
<i>Acarospora glaucocarpa</i> (Wahlenb. ex Ach.) Körb.	[specimens = <i>Sarcogyne wheeleri</i> K. Knudsen, J.H. Adams, Kocourk. & Y. Wang]
<i>Anisomeridium nyssaegenum</i> (Ellis & Everh.) R.C. Harris	<i>Anisomeridium polypori</i> (Ellis & Everh.) M.E. Barr
<i>Arthonia caesia</i> (Flot.) Körb.	<i>Chrysothrix caesia</i> (Flot.) Ertz & Tehler
<i>Arthopyrenia epidermidis</i> (DC.) A. Massal.	<i>Naetrocymbe punctiformis</i> (Pers.) R.C. Harris
<i>Arthothelium ruanum</i> (A. Massal.) Zwackh	<i>Arthonia ruana</i> A. Massal.
<i>Aspicilia cinerea</i> (L.) Körb.) var. <i>laevata</i> (Ach.) Körb.	<i>Aspicilia laevata</i> (Ach.) Arnold
<i>Bacidia beckhausii</i> Körb.	<i>Biatora beckhausii</i> (Körb.) Tuck.
<i>Bacidia inundata</i> (Fr.) Körb.	<i>Bacidina inundata</i> (Fr.) Vězda
<i>Bacidia obscurata</i> (Sommerf.) Zahlbr.	<i>Mycobilimbia tetramera</i> (De Not.) Vitik., Ahti, Kuusinen, Lommi & T. Ulvinen
<i>Bacidia sabuletorum</i> (Schreb.) Lettau	<i>Bilimbia sabuletorum</i> (Schreb.) Arnold
<i>Bacidia sphaerioides</i> (Dickson) Zahlbr.	<i>Mycobilimbia carnealbida</i> (Müll. Arg.) S. Ekman & Printzen
<i>Bellemeria</i> sp.	<i>Bellemeria cinereorufescens</i> (Ach.) Clauzade & Roux
<i>Buellia dialyta</i> (Nyl.) Tuck.	<i>Chrimofulvea dialyta</i> (Nyl.) Marbach
<i>Buellia turgescens</i> Tuck.	<i>Buellia badia</i> (Fr.) A. Massal.
<i>Buellia polyspora</i> (Willey in Tuck.) Vainio	<i>Amandinea polyspora</i> (Willey) E. Lay & P. May
<i>Buellia punctata</i> (Hoffm.) Massal.	<i>Amandinea punctata</i> (Hoffm.) Coppins & Scheid.
<i>Catinaria laureri</i> (Hepp ex Th. Fr.) Degel.	<i>Megalaria laureri</i> (Hepp ex Th. Fr.) Hafellner
<i>Cetraria ciliaris</i> Ach. var. <i>ciliaris</i>	<i>Tuckermannopsis ciliaris</i> (Ach.) Gyeln.
<i>Cetraria ciliaris</i> var. <i>halei</i> (W.L. Culb. & C.F. Culb.) Ahti	<i>Tuckermannopsis americana</i> (Spreng.) Hale
<i>Cetraria oakesiana</i> Tuck.	<i>Usnocetraria oakesiana</i> (Tuck.) M.J. Lai & C.J. Wei
<i>Cetraria pinastri</i> (Scop.) S. Gray	<i>Vulpicida pinastri</i> (Scop.) J.-E. Mattsson & M.J. Lai
<i>Cetraria sepincola</i> (Ehrh.) Ach.	<i>Tuckermannopsis sepincola</i> (Ehrh.) Hale
<i>Cladonia mitis</i> (Sandst.) Hustich	<i>Cladonia mitis</i> Sandst.
<i>Cladonia rangiferina</i> (L.) Nyl.	<i>Cladonia rangiferina</i> (L.) F.H. Wigg.
<i>Cladonia stellaris</i> (Opiz) Brodo	<i>Cladonia stellaris</i> (Opiz) Pouzar & Vězda
<i>Cladonia bacillaris</i> Nyl.	<i>Cladonia macilenta</i> Hoffm. var. <i>bacillaris</i> (Genth) Schaer.
<i>Cladonia cervicornis</i> (Ach.) Flot. subsp. <i>verticillata</i> (Hoffm.) Ahti	<i>Cladonia verticillata</i> (Hoffm.) Schaer.
<i>Cladonia dahliana</i> Kristinsson	<i>Cladonia symphylicarpa</i> (Flörke) Fr., psoromic acid chemotype
<i>Cladonia ramulosa</i> (With.) J.R. Laundon	[specimens = <i>Cladonia ignatii</i> Ahti, Pino-Bodas & J.W. McCarthy]
<i>Collema bachmanianum</i> (Fink) Degel.	<i>Enchylium bachmanianum</i> (Fink) Otálora, P.M. Jørg. & Wedin
<i>Collema coccophorum</i> Tuck.	<i>Enchylium coccophorum</i> (Tuck.) Otálora, P.M. Jørg. & Wedin
<i>Collema fuscovirens</i> (With.) J.R. Laundon	<i>Lathagrium fuscovirens</i> (With.) Otálora, P.M. Jørg. & Wedin
<i>Collema limosum</i> (Ach.) Ach.	<i>Enchylium limosum</i> (Ach.) Otálora, P.M. Jørg. & Wedin
<i>Collema polycarpon</i> Hoffm.	<i>Enchylium polycarpon</i> (Hoffm.) Otálora, P.M. Jørg. & Wedin

Name in Brodo (1988)

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<i>Collema tenax</i> (Sw.) Ach. <i>em.</i> Degel.	<i>Enchylium tenax</i> (Sw.) Otálora, P.M. Jørg. & Wedin
<i>Conotrema urceolatum</i> (Ach.) Tuck.	<i>Stictis urceolatum</i> (Ach.) Gilenstam
<i>Cyphelium tigillare</i> (Ach.) Ach.	<i>Calicium tigillare</i> (Ach.) Pers.
<i>Dimerella lutea</i> (Dickson) Trev.	<i>Coenogonium luteum</i> (Dickson) Kalb & Lücking
<i>Dimerella pineti</i> (Schrad. <i>ex</i> Ach.) Vězda	<i>Coenogonium pineti</i> (Schrad. <i>ex</i> Ach.) Lücking & Lumbsch
<i>Endocarpon pusillum</i> Hedwig	[specimens = <i>Endocarpon pallidulum</i> (Nyl.) Nyl.]
<i>Eopyrenula leucoplaca</i> (Wallr.) R.C. Harris	[specimens = <i>Eopyrenula intermedia</i> Coppins]
<i>Haematomma elatinum</i> (Ach.) A. Massal.	<i>Loxospora elatina</i> (Ach.) A. Massal.
<i>Haematomma ochrophaeum</i> (Tuck.) A. Massal.	<i>Loxospora ochrophaea</i> (Tuck.) R.C. Harris
<i>Haematomma pustulatum</i> Brodo & W.L. Culb.	<i>Lepra pustulata</i> (Brodo & W.L. Culb.) Lendemer & R.C. Harris
<i>Hymenelia lacustris</i> (With.) Poelt & Vězda	<i>Ionaspis lacustris</i> (With.) Lutzoni
<i>Hypocomyce anthracophila</i> (Nyl.) P. James & Gotth. Schneid.	<i>Carbonicola anthracophila</i> (Nyl.) Bendiksby & Timdal
<i>Hypocomyce friesii</i> (Ach.) P. James & Gotth. Schneid.	<i>Xylopsora friesii</i> (Ach.) Bendiksby & Timdal
<i>Lecania cyrtellina</i> (Nyl.) Sandst.	<i>Lecania cyrtella</i> (Ach.) Th. Fr.
<i>Lecanora chlorophaeodes</i> Nyl.	[specimens = <i>Rhizoplaca weberi</i> (Ryan) Leavitt, Zhao Xin & Lumbsch]
<i>Lecanora crenulata</i> Hook.	<i>Myriolecis crenulata</i> (Hook.) Śliwa, Zhao Xin & Lumbsch
<i>Lecanora dispersa</i> (Pers.) Sommerf.	<i>Myriolecis dispersa</i> (Pers.) Śliwa, Zhao Xin & Lumbsch
<i>Lecanora fuliginosa</i> Brodo	<i>Lecanora argentea</i> Oxner & Volkova
<i>Lecanora hagenii</i> (Ach.) Ach.	<i>Myriolecis hagenii</i> (Ach.) Śliwa, Zhao Xin & Lumbsch
<i>Lecanora muralis</i> (Schreb.) Rabenh.	<i>Protoparmeliopsis muralis</i> (Schreb.) M. Choisy
<i>Lecanora opiniconensis</i> Brodo	<i>Rhizoplaca opiniconensis</i> (Brodo) Leavitt, Zhao Xin & Lumbsch
<i>Lecanora pallida</i> (Schreb.) Rabenh. var. <i>rubescens</i> Imsh. & Brodo	<i>Lecanora albella</i> (Pers.) Ach. (including var. <i>rubescens</i>)
<i>Lecanora piniperda</i> Körb.	<i>Lecanora albellula</i> Nyl.
<i>Lecanora sambuci</i> (Pers.) Nyl.	<i>Myriolecis sambuci</i> (Pers.) Śliwa, Zhao Xin & Lumbsch
<i>Lecanora symmictera</i> Nyl.	<i>Lecanora symmicta</i> (Ach.) Ach.
<i>Lecanora umbrina</i> (Ach.) A. Massal. f. <i>gregata</i> Harm.	[specimens = <i>Myriolecis hagenii</i> (Ach.) Śliwa, Zhao Xin & Lumbsch or other <i>Myriolecis</i> spp.]
<i>Lecanora</i> sp. #3	<i>Myriolecis</i> sp.??
<i>Lecidea berengeriana</i> (A. Massal.) Nyl.	<i>Mycobilimbia berengeriana</i> (A. Massal.) Hafellner & V. Wirth
<i>Lecidea botryosa</i> (Fr.) Th. Fr.	<i>Hertelidea botryosa</i> (Fr.) Printzen & Kantvilas
<i>Lecidea delincta</i> Nyl.	<i>Bryobilimbia ahlesii</i> (Körb.) Fryday, Printzen & S. Ekman
<i>Lecidea elabens</i> Fr.	<i>Ramboldia elabens</i> (Fr.) Kantvilas & Elix
<i>Lecidea erratica</i> Körb.	<i>Leimonis erratica</i> (Körb.) R.C. Harris & Lendemer
<i>Lecidea helvola</i> (Körb. <i>ex</i> Hellb.) H. Olivier	[specimens = <i>Biatora vernalis</i> (L.) Fr. or <i>Biatora pycnidata</i> Printzen & Tonsberg.]
<i>Lecidea</i> sp. #4 sensu Harris (1977)	<i>Lecania croatica</i> (Zahlbr.) Kotlov
<i>Lecidea vernalis</i> (L.) Ach.	<i>Biatora vernalis</i> (L.) Fr.
<i>Lempholemma myriococcum</i> (Ach.) Th. Fr.	<i>Lempholemma polyanthes</i> (Bernh.) Malme
<i>Lempholemma</i> sp.	[specimens = <i>Lempholemma chalazanum</i> (Ach.) B. de Lesd.]

Name in Brodo (1988)	Accepted name
<i>Lepraria incana</i> (L.) Ach.	[specimens = misidentifications of other species of <i>Lepraria</i> , especially <i>L. caesiella</i> R.C. Harris]
<i>Lepraria membranacea</i> auct.	[specimens = <i>Lepraria oxybapha</i> Lendemer or <i>L. normandinioides</i> Lendemer & R.C. Harris]
<i>Lepraria zonata</i> Brodo	<i>Lepraria neglecta</i> (Nyl.) Erichsen
<i>Leptogium azureum</i> (Sw.) Mont.	[specimen appears to be a non-isidiate <i>L. cyanescens</i>]
<i>Leptogium burnetiae</i> Dodge var. <i>hirsutum</i> (Sierk) P.M. Jørg.	<i>Leptogium hirsutum</i> Sierk
<i>Leptogium dactylinum</i> Tuck.	<i>Scytinium dactylinum</i> (Tuck.) Otálora, P.M. Jørg. & Wedin
<i>Leptogium juniperinum</i> Tuck.	[specimens = <i>Leptogium rivulare</i> (Ach.) Mont.]
<i>Leptogium lichenoides</i> (L.) Zahlbr.	<i>Scytinium lichenoides</i> (L.) Otálora, P.M. Jørg. & Wedin
<i>Lobaria quercizans</i> Michx.	<i>Ricasolia quercizans</i> (Michx.) Stizenb.
<i>Megalospora porphyritis</i> (Tuck.) R.C. Harris	[specimens = <i>Megalalaria tuberculosa</i> (Fée) Sipman??]
<i>Melanelia disjuncta</i> (Erichsen) Essl.	<i>Montanelia disjuncta</i> (Erichsen) Divakar, A. Crespo, Wedin & Essl.
<i>Melanelia exasperatula</i> (Nyl.) Essl.	<i>Melanohalea exasperatula</i> (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch
<i>Melanelia olivacea</i> (L.) Essl.	<i>Melanohalea olivacea</i> (L.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch
<i>Melanelia septentrionalis</i> (Lynge) Essl.	<i>Melanohalea septentrionalis</i> (Lynge) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch
<i>Melanelia sorediata</i> (Ach.) Goward & Ahti	<i>Montanelia sorediata</i> (Ach.) Divakar, A. Crespo, Wedin & Essl.
<i>Melanelia subaurifera</i> (Nyl.) Essl.	<i>Melanelixia subaurifera</i> (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch
<i>Micarea bauschiana</i> (Körb.) Wirth & Vězda	<i>Brianaria bauschiana</i> (Körb.) S. Ekman & M. Svensson
<i>Ochrolechia rosella</i> (Tuck.) Vers.	<i>Ochrolechia trochophora</i> (Vain.) Oshio var. <i>trochophora</i>
<i>Opegrapha varia</i> Pers.	<i>Alyxoria varia</i> (Pers.) Ertz & Tehler
<i>Pannaria ahlneri</i> P.M. Jørg.	<i>Fuscopannaria ahlneri</i> (P.M. Jørg.) P.M. Jørg.
<i>Pannaria leucophaea</i> (Vahl) P.M. Jørg.	<i>Vahliella leucophaea</i> (Vahl) P.M. Jørg.
<i>Parmelina aurulenta</i> (Tuck.) Hale	<i>Myelochroa aurulenta</i> (Tuck.) Elix & Hale
<i>Parmelina galbina</i> (Ach.) Hale	<i>Myelochroa galbina</i> (Ach.) Elix & Hale
<i>Parmelina obsessa</i> (Ach.) Hale	<i>Myelochroa obsessa</i> (Ach.) Elix & Hale
<i>Peltigera polydactyla</i> (Neck.) Hoffm. <i>s. lat.</i>	<i>Peltigera polydactylon</i> (Neck.) Hoffm.
<i>Pertusaria amara</i> (Ach.) Nyl.	<i>Lepra amara</i> (Ach.) Hafellner
<i>Pertusaria leucostoma</i> (Bernh.) A. Massal.	<i>Pertusaria leioplaca</i> DC.
<i>Pertusaria multipunctoides</i> Dibben	<i>Lepra multipunctoides</i> (Dibben) Lendemer & R.C. Harris
<i>Pertusaria ophthalmiza</i> (Nyl.) Nyl.	<i>Lepra ophthalmiza</i> (Nyl.) Hafellner
<i>Pertusaria trachythallina</i> Erichsen	<i>Lepra trachythallina</i> (Erichsen) Lendemer & R.C. Harris
<i>Pertusaria velata</i> (Turner) Nyl.	<i>Varicellaria velata</i> (Turner) Schmitt & Lumbsch
<i>Pertusaria waghernei</i> Hulting	<i>Lepra waghernei</i> (Hulting) Lendemer & R.C. Harris
<i>Phaeophyscia cernohorskyi</i> (Nádv.) Essl.	<i>Phaeophyscia hirsuta</i> (Mereschk.) Essl.
<i>Phaeophyscia endococcina</i> (Körb.) Moberg	[specimens = <i>P. decolor</i> (Kashiw.) Essl.]
<i>Phaeophyscia imbricata</i> (Vain.) Essl.	[specimens = <i>Phaeophyscia squarrosa</i> Kashiw.]

Name in Brodo (1988)**Accepted name**

<i>Physcia subtilis</i> Degel.	[specimens = <i>P. thomsoniana</i> Essl.]
<i>Physconia distorta</i> (With.) J.R. Laundon	[specimens = <i>Physconia subpallida</i> Essl.]
<i>Plagiocarpa hyalospora</i> (Nyl.) R.C. Harris	<i>Lithothelium hyalosporum</i> (Nyl.) Aptroot
<i>Plagiocarpa macrospora</i> R.C. Harris	<i>Lithothelium macrosporum</i> (R.C. Harris) Aptroot
<i>Plagiocarpa phaeospora</i> R.C. Harris	<i>Lithothelium phaeosporum</i> (R.C. Harris) Aptroot
<i>Plagiocarpa septemseptata</i> R.C. Harris	<i>Lithothelium septemseptata</i> (R.C. Harris) Aptroot
<i>Polysporina simplex</i> (Dav.) Vězda	<i>Acarospora privigna</i> (Ach.) A. Schneid.
<i>Porpidia cinereoatra</i> (Ach.) Hertel & Knoph	[specimens = <i>Porpidia subsimplex</i> (H. Magn.) Fryday]
<i>Rhizocarpon hochstetteri</i> (Körb.) Vainio	[specimens = <i>Rhizocarpon infernulum</i> (Nyl.) Lyngé f. <i>sylvaticum</i> Fryday]
<i>Rhizocarpon obscuratum</i> (Ach.) A. Massal.	[specimens = <i>Rhizocarpon reductum</i> Th. Fr.]
<i>Rhizocarpon plicatile</i> (Leight.) A.L. Sm.	<i>Rhizocarpon rubescens</i> Th. Fr.
<i>Rhizoplaca chrysoleuca</i> (Sm.) Zopf	[specimens = <i>Rhizoplaca subdiscrepans</i> (Nyl.) R. Sant.]
<i>Rinodina dakotensis</i> H. Magn.	<i>Amandinea dakotensis</i> (H. Magn.) P. May & Sheard
<i>Rinodina farinosa</i> Sheard, ined.	<i>Rinodina efflorescens</i> Malme
<i>Rinodina glauca</i> Ropin	<i>Rinodina freyi</i> H. Magn.
<i>Rinodina iowensis</i> Zahlbr.	[specimens = <i>Rinodina moziana</i> (Nyl.) Zahlbr.]
<i>Rinodina magnussonii</i> Sheard, ined	<i>Rinodina freyi</i> H. Magn.
<i>Rinodina thujae</i> (H. Magn.) Sheard	<i>Rinodina excrescens</i> Vain.
<i>Sarcogyne privigna</i> (Ach.) A. Massal.	<i>Sarcogyne hypophaea</i> (Nyl.) Arnold
<i>Staurothele catalepta</i> auct.	<i>Staurothele monicae</i> (Zahlbr.) Wetmore
<i>Staurothele diffractella</i> (Nyl.) Tuck.	<i>Willeya diffractella</i> (Nyl.) Müll. Arg.
<i>Thyrea nigritella</i> Lettau	<i>Lichinella nigritella</i> (Lettau) P.P. Moreno & Egea
<i>Thyrea pulvinata</i> (Schaer.) A. Massal.	[specimens = <i>Thyrea confusa</i> Henssen]
<i>Trapelia involuta</i> (Taylor) Hertel	<i>Trapelia glebulosa</i> (Sm.) J.R. Laundon
<i>Trypethelium virens</i> Tuck. ex E. Michen.	<i>Viridothelium virens</i> (Tuck. ex E. Michen.) Lücking, M.P. Nelson & Aptroot
<i>Umbilicaria vellea</i> (L.) Ach.	[specimens = <i>Umbilicaria americana</i> Poelt & T.H. Nash]
<i>Usnea filipendula</i> Stirton	<i>Usnea dasopoga</i> (Ach.) Nyl.
<i>Verrucaria calciseda</i> DC.	<i>Bagliettoa calciseda</i> (DC.) Gueidan & Cl. Roux
<i>Verrucaria fuscella</i> (Turner) Winch	<i>Placopyrenium fuscillum</i> (Turner) Gueidan & Cl. Roux
<i>Xanthoparmelia somloënsis</i> (Gyeln.) Hale	[specimens = <i>Xanthoparmelia viriduloumbrina</i> (Gyeln.) Lendemer]
<i>Xanthoria elegans</i> (Link) Th. Fr.	<i>Rusavskia elegans</i> (Link) S.Y. Kondr. & Kärnefelt
<i>Xanthoria fallax</i> (Hepp ex Arnold) Arnold	<i>Xanthomendoza fallax</i> (Hepp ex Arnold) Søchting, Kärnefelt & S.Y. Kondr.

Discussion*Changes in landscape, habitat, and lichen diversity*

Many lichens originally present in the Ottawa region have not been collected since 1930 and appear to have been lost along with the original forests they inhabited. Wong and Brodo (1992) reported 41 such losses from southern Ontario, including *Anzia colpodes* (Ach.) Stizenb., *Leptogium corticola* (Taylor) Tuck., and *Pyrrhospora varians* (Ach.) R.C. Harris from the Ottawa region. Several of the species that we

now report as additions actually date from that early period rather than the present, but they were only recently recognized among Macoun's pre-1900 collections, with no modern specimens recorded in the region (e.g., *Anaptychia crinalis*, *Parmotrema subtinctorium*, and *Pyrenula micheneri*). On the other hand, some species on the Wong and Brodo (1992) list of lichens not found since 1930 have recently been rediscovered, e.g., *Scytinium tenuissimum*, *Phaeocalicium polyporeum*, and, just outside the boundaries of

the Ottawa region near White Lake, *Megaspora verucosa* (Ach.) L. Arcadia & A. Nordin and *Leptogium corticola*.

Following deforestation during the 1800s (through the initial waterway-based lumber trade, clearing for agriculture, and forest fires), some lands were abandoned for cultivation owing to wet, thin, or excessively sandy or stony soil. Ring counts on fresh stumps and tree cores (R.E.L. unpubl. data) reveal that these marginal lands have been reverting to mixed forest vegetation for the past 70–150 years, and, in a few places, 200 years. Maples, oaks, and pines are frequent; ash or cedar swamps are not uncommon. Those recovering woodlots and swamps in private hands have been subject to selective woodcutting that has tended to remove the biggest and oldest, as well as the most “defective” trees—the very trees most likely to host a diversity of lichens. Even the oldest of these regenerating forests and swamps, however, are second-growth and fall short of re-establishing the old-growth conditions required by most calicioid lichens and fungi (Selva 2003). The Ottawa Greenbelt and Gatineau Park were withdrawn from timber and firewood extraction when they became public conservation lands over 60 years ago.

The area covered by woodlands seems to have remained stable over the past three decades, with destruction by urban development apparently balanced by regrowth, but forest diversity is being diminished by invasive fungal pathogens and insects. Twenty percent (eight of ~40) of the native tree species are declining significantly and may be lost (R.E.L. pers. obs.). The three local species of elm are in slow decline because of Dutch elm disease, which first peaked around 1970, but is now killing younger, succeeding generations (Swingle and Whitten 1967; R.E.L. unpubl. data). Butternut is severely afflicted with the novel Butternut canker disease, which appeared here around 1990 and had killed half the trees by 2010 (Lee 2010). All three local species of ash are rapidly being eliminated in the region by Emerald Ash Borer (*Agilus planipennis*), which had a solid foothold in Ottawa by 2009 (Lee 2020). American Beech, which is in the first, insect-mediated stage of beech bark scale disease, was noted locally in 2016 (R.E.L. unpubl. data).

Particularly hard-hit are Black Ash swamps, which in some areas no longer support living Black Ash trees. Lichen species that are more or less locally restricted to Black Ash include *Arthonia fuliginosa*, *Scytinium tenuissimum*, *S. subtile*, and *Strangospora moriformis*. Most local populations of Flooded Jellyskin (*Leptogium rivulare*) are on ash, too. These species are now presumably in decline in the Ottawa area. The same may occur for *Viridothelium virens* as

American Beech begins to die.

Cultivated tree species have become widespread across the settled parts of the Ottawa region, and some of them, especially rosaceous trees such as apple, amelanchier, and cherry, host a rich variety of lichens. Nursery stock from outside the region has resulted in the apparent introduction of *Xanthoria parietina* into managed parks and around homes (C.F., C.J.L., and I.M.B. unpubl. data). This species normally occurs along the Atlantic coast of North America and the Niagara escarpment in southern Ontario, 400 km from Ottawa (Brodo *et al.* 2007).

Thus, for lichens that grow on trees or rocks generally, and specialists that occur only on certain species of trees, or prefer rocks of either acidic or calcareous nature, a wide range of substrates is available within the region. Exceptionally, too, small patches of forest or swamp not immediately recognizable as old growth have been found to have very old trees supporting lichens associated with extended forest continuity (Lesica *et al.* 1991; Selva 1994; McMullin *et al.* 2008). Given the apparently limited ability of such lichens to become established in emerging habitat, it appears that these particular lichen populations have persisted throughout the post-settlement period.

Lichens and climate change

Warming trends have been noted in the Ottawa region, as they have in other parts of Canada. The mean annual temperature in Ontario is already 1.5°C warmer than it was in 1950 (OCCIAR 2015). The possibility of change in lichen communities in response to a warming climate has been of interest since van Herk *et al.* (2002) related rising temperature to increases in “warmth-loving” species and declines in “boreo-alpine” species in the Netherlands. Although the rise in average temperature reported there (0.8°C) was comparable to the 1°C rise recorded in Ottawa (Catling 2016), an increase that was regarded to be sufficient to explain the northern range extension of two dragonflies (Catling 2016), we have not observed such changes in the lichen biota.

Van Herk *et al.* (2002) were exploring the possibility of temperature having a ‘direct’ effect on the limiting factors of lichen distributions. In the Ottawa region, however, we are witnessing ‘indirect’ effects. As noted above, for example, particular tree species that certain substrate-specific lichens grow on are either dying back or dying out in the Ottawa region because of infestations of alien insects. Changes in climate may well be affecting the range of these insects rather than the lichens themselves. It may work as follows.

In contrast with the imperceptible rise of the annual mean temperature, the rate at which episodes of extreme cold have eased is dramatic. Extreme lows in recent decades have been 6–7°C warmer than they

were 70 years ago. From the 1920s through the 1950s, the Ottawa region (as measured at the Central Experimental Farm, CDA station) experienced from one to three years in each decade with low temperatures falling to -37°C or below, but not since 1959. Extreme lows from 1990 to the present have been around -31°C (Osborn 2020, summarizing the dataset in Government of Canada 2020b). This trend has been noted globally as well (Folland *et al.* 2001).

Viridothelium virens, as noted above, occurs in the Ottawa region only on American Beech, and from what we see, we predict a significant die-off over the next 10 years or so as the newly arrived Beech-bark Scale (*Cryptococcus fagi* Baer.) initiates the trees' ultimate destruction by a pathogenic fungus. Winter temperatures of -37°C kill most of the scale insects and have, in the past, been credited with controlling their northward spread (Shigo and Stone 1967).

Also as noted above, a small number of other lichen species are represented in the Ottawa region only by specimens collected from ash trees, and we have observed that the local populations of ash species are dying following invasion by Emerald Ash Borer, a widespread phenomenon in eastern North America (COSEWIC 2018). The failure to maintain extreme lows has probably also been a factor enabling the spread of this beetle into the Ottawa region, as this insect experiences high overwintering mortality at -35°C (Christianson and Venette 2018; COSEWIC 2018).

Unusual warmth might have another indirect effect on lichens. Pale-bellied Frost Lichen (*Physconia subpallida*; Figure 2) is listed as Endangered or "Imperiled" both provincially (OMNR 2018) and federally (SARA Registry 2021b). Common enough and more varied in its range of substrates in John Macoun's time, within the Ottawa region it is now known only from a small area near the summit of King Mountain in Gatineau Park (McMullin *et al.* 2016). There, it is found only on White Oak and Eastern Hop-hornbeam. When, in the summer of 2012, the mean temperature was nearly 2°C above 1970 levels and followed an extended period of below-normal precipitation, Annecou (2014) observed that hectares of hardwood forest at several points along the crest of Gatineau Park's southwest-facing escarpment in Quebec turned colour in July and dropped their leaves. Some trees died that year, and more the next. At the King Mountain site, she found that 23 of 37 (62%) White Oaks in semi-open woodland had died by 2013 (Annecou 2014). Although the *P. subpallida* populations discovered in 2016 were on trees that had survived the drought of 2012, it is not known how many might have been lost. More severe droughts are likely. Annecou (pers. comm. 2019) suggests that there may eventually be

a shift there from forest to savannah-like conditions that are unsuitable for *P. subpallida*.

As so many of our lichens grow on trees, changing environmental factors related to climate that affect the forest flora may, in turn, become significant in determining the future composition of the lichen biota.

"Hot-spots" of diversity

With the benefit of more than 50 years of concentrated study of the Ottawa region's lichen biota, it is now possible to highlight some areas that have unusually high lichen diversity, the "hot-spots" (Figure 1). As mentioned above, Gatineau Park and Ottawa's Greenbelt forest are rich in lichens, but even within these areas, some specific habitat types are more diverse than others.

Old-growth maple forests—Old-growth forests, characterized by deep soil, ample moisture, and old trees with soft bark, are mainly found on the Quebec side of the river, especially in Gatineau Park (e.g., the MacDonald Bay area of Lac Meech and some forests adjoining Lac la Pêche). Indicator species include calicioid lichens and fungi, *Alyxoria varia*, *Bacidia rubella* (Hoffm.) A. Massal., *Cresponea chloroconia*, *Inoderma byssaceum*, and *Lobaria pulmonaria* (L.) Hoffm.

Gatineau escarpment—Elevated temperatures on the south-facing rocky cliffs of Gatineau Park are suitable for a special forest type including White Oaks, as well as exposed outcroppings of granite and, in a few spots, calcareous marble. These combine to produce conditions suitable for many rarities including *Phaeocalicium minutissimum*, *Physconia subpallida*, *Porpidia soredizodes*, and *Rhizocarpon lecanorinum* Anders. Of particular note are two escarpment localities associated with streams and waterfalls: Church Hill near Eardley, and Luskville Falls above Luskville. The latter has a number of rarities in and around the stream and falls, e.g., *Chaenotheca xyloxena*, *C. perforata*, *Flavoparmelia flaventior*, *Phaeocalicium populneum*, *Placynthium flabellulosum*, *Porpidia sub-simplex*, *Ramalina intermedia*, *Rhizocarpon lavatum* (Fr.) Hazsl., and *Scytinium tenuissimum*. At Church Hill, rarities were found, such as *Trapeliopsis gelatinosa*, *Dictyocatenulata alba*, and *Merismatium peregrinum* growing on thalli of *Rimularia badioatra* (both rare).

Alvars—In the Burnt Lands area near Almonte and Packenham on the Ontario side of the Ottawa River, and along the Ottawa River near Pontiac on the Quebec side, there are areas of exposed limestone pavement with scattered trees and shrubs (including Eastern Red Cedar [*Juniperus virginiana* L.] and Canada Yew [*Taxus canadensis* Marshall]) with many rare vascular plants, animals, and lichens (Catling 2013; Catling *et al.* 2014). Examples of the latter include

Heppia adglutinata, *Placidium squamulosum*, *Psora decipiens*, and *Thyrea confusa*.

Old White Cedar swamps—White Cedar is a common tree in the Ottawa region, with older trees supporting an unusual lichen biota including *Biatora* spp., *Menegazzia terebrata* (Hoffm.) A. Massal., and *Parmotrema crinitum*. Some relatively old cedar stands are in the Greenbelt, and others are just outside the 50-km radius in the White Lake area.

Blakeney Rapids Provincial Park—This surprising hot-spot of diversity and rare taxa supports a stand of mature maple, White Pine, White Cedar, elm, and hemlock along the Mississippi River where the river makes a sharp turn, first to the northeast, then to the northwest, creating a series of rapids that flow over and between small islands just off the shore of the peninsula. On shore, an outcrop of granite has formed a grotto of shaded, mossy, vertical rock walls. A “bioblitz” at this locality in 2000 uncovered a dazzling array of rare lichens on the rock walls and trees including *Porpidia soredizodes*, *Rinodina destituta*, *R. siouxiana*, and *Trapelia stipitata*. In the list of 42 species collected on the bioblitz, nearly 40% (17) are uncommon or rare in the Ottawa Region. A number of other, more common species reliably identified in the field were recorded as sight records. It is likely that the moist air associated with the rapids, especially in spring, promotes a rich variety of saxicolous and corticolous lichens.

Conclusions

Over the past 32 years, the known lichen biota of the Ottawa region has increased by over 40% mainly because of new lichenological studies and intensive fieldwork. The actual increase in number of species in the region, however, has probably been small and is more than offset by the loss of species due to habitat reduction resulting from urbanization and climate change. On the other hand, the improvement in air quality throughout the region has resulted in an increase in lichen cover in most areas. In the decades ahead, we will undoubtedly see additional changes and discoveries.

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