OMPHALINA

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Sep 27, 2017

FORAY NEWFOUNDLAND AND LABRADOR

is an amateur, volunteer-run, community, not-for-profit organization with a mission to organize enjoyable and informative amateur mushroom forays in Newfoundland and Labrador and disseminate the knowledge gained.

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OMPHALINA, *newsletter of Foray Newfoundland & Labrador, has no fixed schedule of publication, and no promise to appear again. Its primary purpose is to serve as a conduit of information to registrants of the upcoming foray and secondarily as a communications tool with members.*

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seened AT *gmail* DOT *com*,

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COVER

Lichenomphalia oreades, Mt Ignoble, October 6, 2012. If you think the picture looks vaguely familiar, you are right. You have seen it inside these pages before. With another name. The why, where & how are inside.

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CONTENT

Message from the Editor

The foray is barely a month behind us, and preparations are already being made for the next one. A Report issue will appear in due course. In the meanwhile, content yourselves with this offering, devoted to keep you abreast of new developments at the outer edge of the advancing mycological envelope made by studies of our own lichenized mycota.

***

Remember the cover on the right: July, 2014, an entire issue devoted to a single species from atop Mt Ignoble? The species was identified as *Arrhenia obscurata*. Hints that two species might be involved were dismissed out of hand as totally illogical by one of the authors, one AV.

There were, of course, two species. Hence, we also know who was totally illogical. The adventures associated with identifying the second species, *Lichenomphalia oreades*, are recounted in this issue.

Why all this fuss for one small, brown mushroom most of us will never see? And the second time yet? Well, because:

1. Past errors must be set aright.

2. We have an omphalinoid as the FNL logo and Omphalina as the name of our journal, so we have an obligation to get at least these mushrooms right. Both *Arrhenia* and *Lichenomphalia* were part of *Omphalina* at one time, so if we do not get it right the first time, then we try however many times it takes.

As for "most of us will never see one"—come on over, and we'll take you up to Mt Ignoble to look for some. It took Maria and me over ten years, before we noticed the first one. This year they were absent earlier, likely because of the hot, dry summer, but just recently have come out in full force.

WARNING: once seen, it will steal your heart.

Our second article reports on a recent publication about the lichens of Salmonier Nature Park (and, in turn, refers to an earlier publication of lichens in some of our other provincial parks). The report appears in the Journal of the Torrey Botanical Society, which, under its earlier name, The Bulletin of the Torrey Botanical Club, is the oldest natural history journal in the Americas. This was where Charles Peck published his earliest reports of new mushroom species (considered to be plants at the time), before his various Reports of the Botanist of New York State.

Happy mushrooming!

ERRATUM

Never assume!

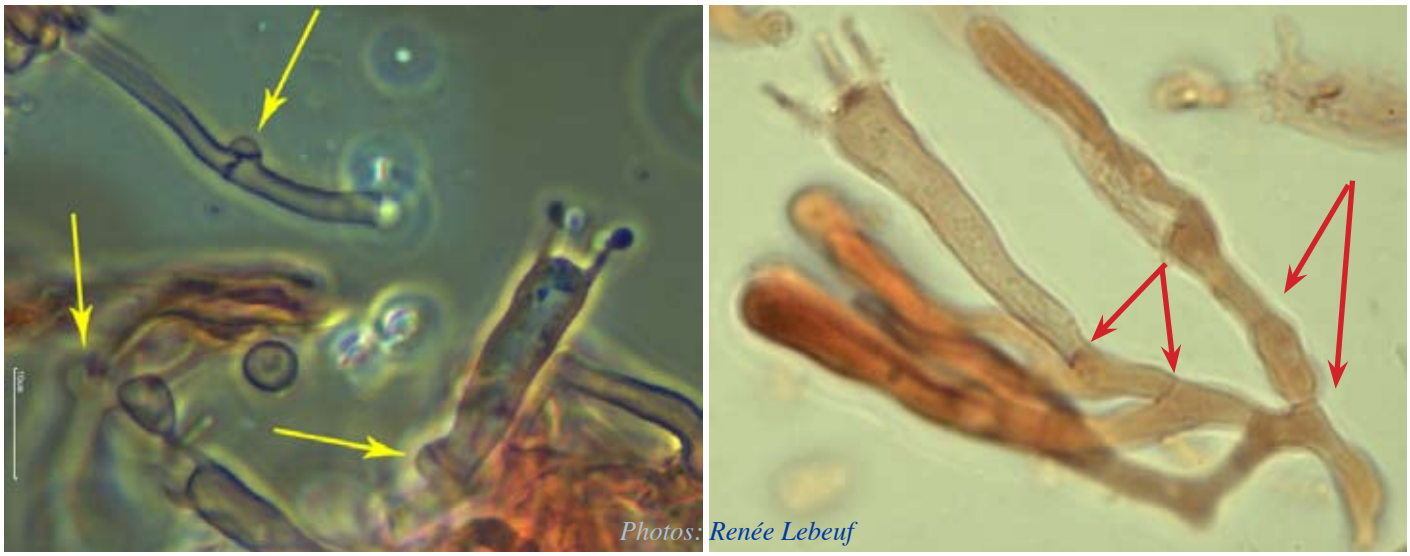
Andrus Voitk

Photo: Roger Smith

Of all the wise things Faye Murrin has told me over the years, the above title has stood the test of time above all others. Sure, her original advice was made in reference to an assumption that somebody else would bring the beer to the foray—as she predicted, a potential recipe for disaster—but it has proven equally applicable to other areas of life. Take, for example, this quote, from an article discussing a small brown omphalinoid mushroom found in cracks atop Mount Ignoble:

… is it possible that our collections are, indeed, of several species? Theoretically, yes, but our combined many hundred years of observing life on this earth argue strongly that it is unlikely to find another, let alone several, species elbowing each other for a chance to grow on and out of bare rock during frost and snow. (Omphalina, vol. 5, nr 7, p 10).

The quote should be attributed to "A. Voitk ex Voitk et al.", to indicate that although it comes from an article by several authors, this particular part is the contribution of one single individual and should not be attributed to the innocent others. In my defense, initially I could not discern two clearly different groups. Under the microscope, it seemed to me that all had clamp connections (Figure 1) at most septa. Actually, after I established that for the first six, I **assumed** they all had clamp connections, making no further effort to document this for the remainder. Never assume!



Photos: Renée Lebeuf

Figure 1. *LEFT: Typical clamp connections (yellow arrows) at septa of the* Arrhenia obscurata *from Mt. Ignoble. RIGHT: Clampless septa (red arrows) of* Lichenomphalia oreades *from Mt Ignoble.*

What is the significance of clamp connections, you might ask? Well, in this setting they are of seminal importance. The dramatic thing about these mushrooms was that they lacked an obvious source of nutrition. The sites where they grew had almost no organic matter to support a saprobic lifestyle, and there were no nearby vascular plants that could be mycorrhizal partners. Looking for alternate partners, we noticed small algal granules around some of these mushrooms. A partnership with algae was an attractive explanation, but so far the only agaric basidiomycetes (cap and stem mushrooms) known to have a partnership with algae belong to the genus *Lichenomphalia*. One of the characteristic features of this genus is the lack of clamp connections (Figure 1). Therefore, to find an agaric basidiomycete algal partner with clamps would be a new discovery.

Then Greg Thorn found that the DNA of one of these mushrooms matched something identified as *Lichenomphalia grisella*. But *Lichenomphalia* do not have clamps. Enter Robert Lücking. Not weighed down by my assumptions, he offered the obvious explanation: there are two species, *Arrhenia obscurata* with clamps and no algal granules, and a *Lichenomphalia* with algal granules and no clamps. He checked the base of the stem of several collections. Those with algal granules enmeshed in the basal mycelium had no clamps, and those without a granular lichen thallus had clamps. Easy.

Now I re-examined every specimen in every collection. As Robert suggested, there were two kinds, about 75% with clamps, and 25% without. No doubt about it: there were two similar but separate species growing in this very small and inhospitable environment, sometimes in very close proximity to each other (Figure 2).

How is it possible that I did not note the absence of clamps of about 25% of specimens? Well, firstly, absence of a character is easier to miss than its presence. After seeing no clamps in the first six, I assumed they were all the same and stopped looking for clamps, concentrating mainly on spores and basidia. Every once in a while clamps were noted in passing, because clamped specimens were more abundant than unclamped ones. And, of course, there is the power of conviction that one's assumption is correct. One of my notations read, "***basal clamp not obvious (possibly subtle?)***." Of course, on review this turned out to be a clampless specimen! I was so convinced of the rightness of my assumption of clamps that I was prepared to fit contrary observations to my theory.

OK, just to set things aright, assumption is not a sin. In fact, it is the basic tool for formulating scientific theories. However, assumptions must not be allowed to replace verifiable facts. They should be tested and, when possible, replaced with real observations, and the theory altered accordingly. The sin is to assume without verification, or to modify your observations to fit the theory. To render an opinion about the emperor's new clothes, keep facts rigid and theory flexible.

My mother told me that I also serve if my life becomes an example to others, something I am now beginning to understand.

Figure 2. *Right:* Arrhenia obscurata *(two bigger ones) and a slightly dried* Lichenomphalia oreades *atop Mt Ignoble. Left: The bigger* Arrhenia *and the* Lichenomphalia *after drying. They grow so close to each other and look so alike tat they can be thought to be one species. Only if you know they are not, can you see some subtle differences: e.g. on the average,* Lichenomphalia *is smaller, lighter in colour, has a shallower navel, and smaller cap diam. / stem length ratio.*

Lichenomphalia oreades

IN EIGHT CHAPTERS

Robert Lücking,
Greg Thorn,
Irja Saar,
Michele Piercey-Normore,
Bibiana Moncada,
Jennifer Doering,
Henry Mann,
Renée Lebeuf,
Maria Voitk,
Andrus Voitk

1. EXECUTIVE SUMMARY

After we realized that we had two similar-appearing, but separate species of small brown mushrooms atop Mt Ignoble, we identified the more abundant one as *Arrhenia obscurata*, but of the other we only knew it was a basidiolichen, because it grew with alga.

Identification of this species is our story.

We found 11 descriptions of species which could fit our find. Of these, only two species had DNA deposited in GenBank, one specimen identified as *Lichenomphalia velutina* and three as *L. grisella*. The DNA of our collections fell nicely into one clade, together with two species identified as *L. grisella*, leaving one *L. grisella* and one *L. velutina* in a sister clade. Clearly, some identification problems required resolution.

We sequenced the type specimen of *L. grisella* and found that it fell into the sister clade to our species. The type specimen is the one by which a species is determined, so we knew that the name of this sister clade was *L. grisella*, and that our specimen and its companions in our clade was not *L. grisella*. Because a similar species named *Omphalina oreades* had been described from the same Appalachian Range of which Mount Ignoble was a small bump, we also sequenced the type specimen of that species. It fell nicely into the same clade with our species, thus identifying ours as *O. oreades*. Of the 11 similar species we had identified, only *L. velutina* was an older name, making it possible that *O. oreades* is a later synonym for *L. velutina*. However, there is no type specimen of *L. velutina*, so that we could not test this, and no collections from the Alps, where it had been first described, had been sequenced. We felt we lacked sufficient information of what grows in the European Alps to make an informed comment about the relationship of this old species to ours, and decided that until such information becomes available, the correct name for our species should be *O. oreades*.

Since the description of *O. oreades*, species associated with alga had been separated from *Omphalina* into a genus of their own, *Lichenomphalia*. Phylogenetically our species also fell into that genus, and, therefore, required formal transfer to *Lichenomphalia*.

We reported our find and made the required transfer in an article in The Licenologist,[1] so that our little mushroom can henceforth be known with its correct name, *Lichenomphalia oreades*. On these pages we recount our adventures and lessons during this process, be it with our own overly hasty conclusions or the post and customs. Transferring one small, brown mushroom from one genus to another is hard work: it took 10 authors, one submission and four revisions, nearly 7,000 words, two tables, ten pictures, and over 50 references. For a smoother reading experience, in our story we have left out references to seminal, cited works. The curious can find all the pertinent material among the 50 plus in the published article. If you would like a copy, just ask.

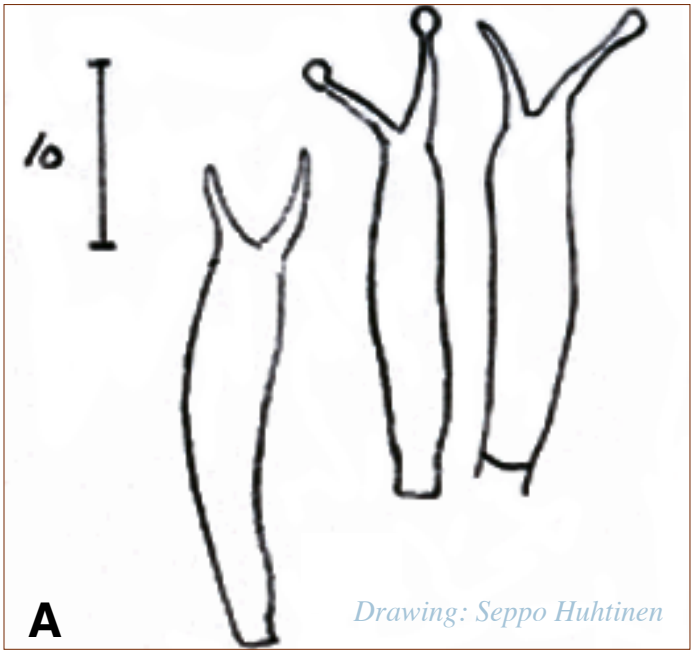
Reference

1. Lücking R, Thorn RG, Saar I, Piercey-Normore M, Moncada B, Doering J, Mann H, Lebeuf R, Voitk M, Voitk A: A hidden basidiolichen rediscovered: *Omphalina oreades* Singer is a separate species in the genus *Lichenomphalia* (Basidiomycota: Agaricales: Hygrophoraceae). The Lichenologist 49: 467–481. 2017.

2. *Lichenomphalia grisella*, I assume? NOT

Once we recognized we were dealing with a *Lichenomphalia* atop Mt Ignoble, the search began: what species was it? We assembled a field of an even dozen possibilities: 11 brown lichenized agarics that we had culled from the literature, and the possibility that it was a new species.

As mentioned, DNA of our species matched two



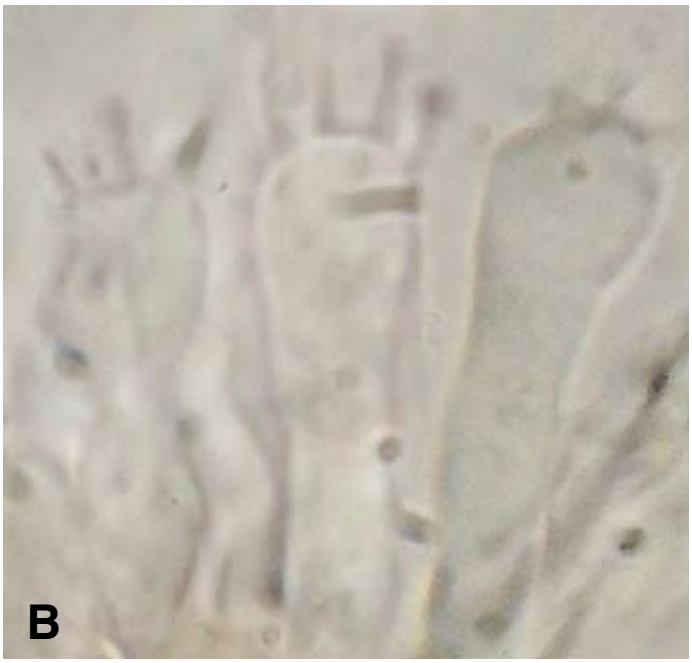


Figure 1. A. *Two-spored basidia of* Omphalia grisella, *drawing of type specimen at H, permission Seppo Huhtinen and University of Helsinki Herbarium (H).* ***B.*** *Four-spored basidia of type specimen of* Omphalina oreades, *on loan from the Farlow Herbarium of Harvard University.* ***C.*** *Four-spored basidia of* L. oreades *from Mt Ignoble. Microscopic examination of basidia, spores, pileipellis and pigmented cells showed ours to resemble the type of* Omphalina oreades, *but not* Omphalia grisella. *These relationships were borne out by phylogenetic analysis.*

deposits in GenBank, identified as *L. grisella*. These deposits hail from the early days of phylogenetics, those heady days, when suddenly we discovered that looking at certain genetic markers enabled us to gain epiphanic insights into evolutionary relationships of mushrooms that we had never had before. This was very exciting. And, once you got the knack, relatively easy. As a result, new species clades began to appear like mushrooms after autumn rain.

However, taxonomy, the naming game, did not have a parallel major advance, and therefore the discovery of new clades markedly outstripped the ability to match them to known type species, often a painstakingly slow, confusing and meticulous effort. In many situations it seemed more expedient to apply names, based on seemingly logical assumptions, based on current knowledge. And we know where assumptions can lead.

At that time, the current accepted assumption was that *L. grisella* was a later name for *L. velutina*, i.e. that the two were the same species. However, finding two genetically different close species, a new assumption was made: the two taxa are different, after all. Further, an arbitrary assumption was made to apply the name *L. grisella* to the four-spored species, and *L. velutina* to the two-spored one. Guess Faye cannot be everywhere with advice regarding assumptions.

To accept our find as *L. grisella* was problematic, because the type of *L. grisella,* has two-spored basidia, whereas ours had four (Figure 1). When Karsten described *L. grisella*, he did not note the number of basidia: this remained hidden in the type species for many years. Now we know that *L. grisella* is one of four species out of the initial dozen with two-spored basidia. This leaves a field of eight potential contenders for our mushroom, and *L. grisella* is not one of them.

Surely, the astute reader detected another untested assumption. Namely, we assume that the sterigma count is of genetic significance. This need not be so. We know of other related species, where genetically conspecific populations produce two-spored basidia in one location and four-spored ones in another. Much more collection and study is needed to test this assumption, but for now available evidence suggests that sterigma count is a reliable differentiating character.

Irja Saar examined and sequenced the type species for *L. grisella*. As expected, it had two-spored basidia. Genetically it did not match our mushroom, but two different GenBank deposits, one identified as *L. velutina* and the other as *L. grisella*.

Our task remained to identify our mushroom out of the narrowed field of eight contenders. Greg Thorn suggested that we consider *Omphalina oreades*, because its description resembles ours and it was first described from Mt. Washington; our Mt Ignoble is a low bump on the same Appalachian Range that includes Mt Washington. We borrowed the type specimen from Farlow Herbarium at Harvard University. Microscopically, it had four-spored basidia, and resembled ours in every regard. Irja sequenced the type specimen of *O. oreades* and found that it was conspecific with ours. Now we had a name that we could apply to our find without any assumptions. Because phylogenetically our mushroom fell into the genus *Lichenomphalia*, the taxon would have to be transferred from *Omphalina* to *Lichenomphallia* to be taxonomically correct by current usage. This we did, as mentioned in the outset, but not without some more adventures that we relate for your pleasure.

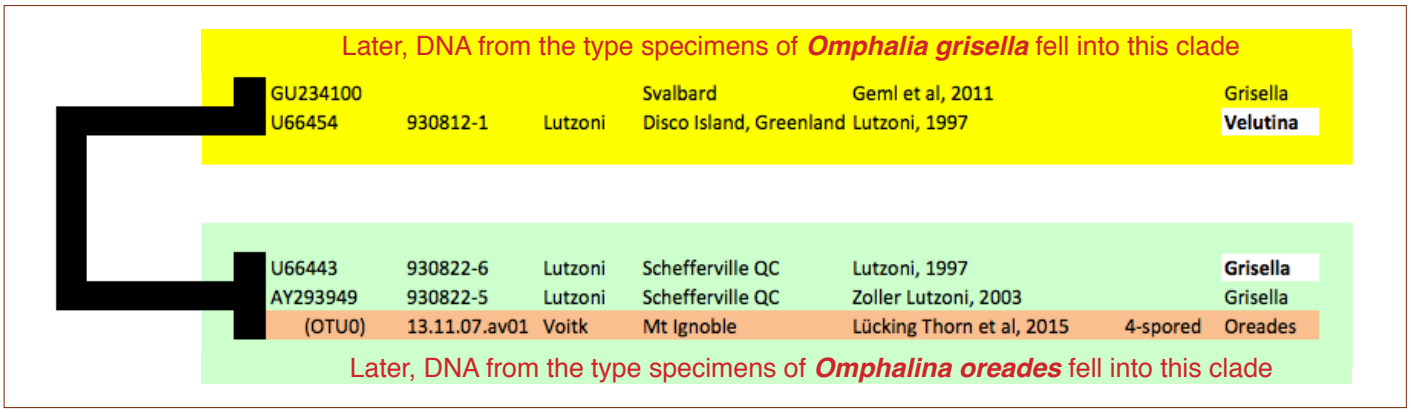


Figure 2. *Our earliest tree (just two twigs, really) showing the first sequence from our mushroom (tan panel) in relation to the four available sequences in GenBank. Original identifications at the far right. Respective placement of the two type specimens studied subsequently, shown in red. These become the correct names for each clade.*

3. Neither snow nor rain nor heat nor gloom of night…

As you learned, many type specimens and other valuable collections were borrowed for study, shipped between our increasing list of collaborators spread across the globe. You may not think about this ordinarily, but the postal and customs systems are an integral part of the infrastructure of science. The title, as most of you know, is not the official motto of the US or any postal service, but a translation from a Greek story about mounted couriers, carved onto the James Farley Post Office in New York City. (Photos from the Internet.)

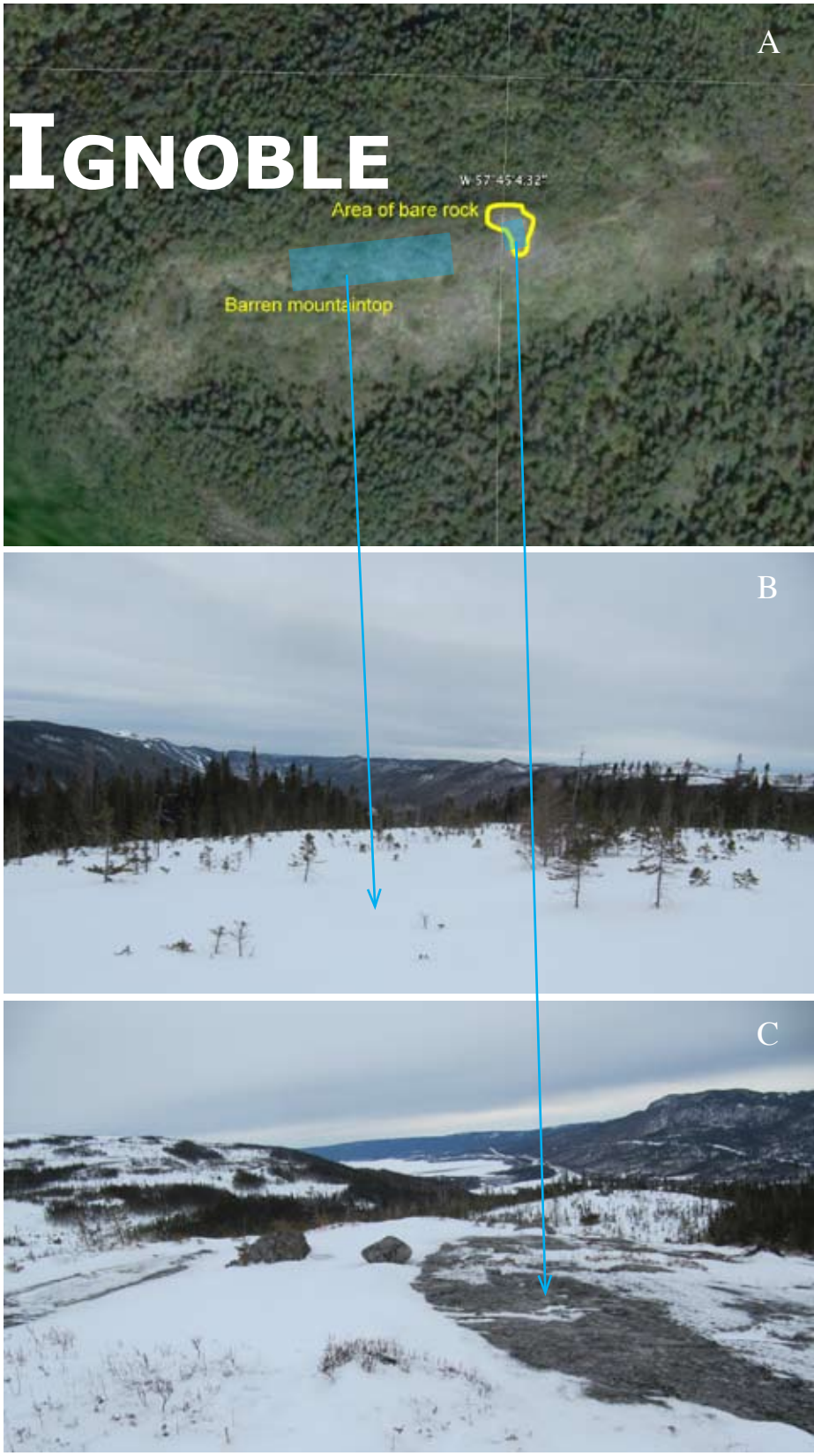
To initiate collaborative studies of NL omphalinoid mushrooms, Andrus Voitk shipped a package of rare and unusual specimens, collected over 15 years from various remote sites, to Robert Lücking, then working at The Field Museum in Chicago. After partial study of this collection, Robert returned the package, because he was moving to Berlin. Like many public institutions, The Field Museum was in a tight budget mode, and to save money, packages were sent unregistered, uninsured, and without tracking number. Unfortunately, the package never arrived back to NL, and despite a clearly marked return address, so far (over 4 years) has not been returned to The Field Museum. Neither US nor Canada Post will look for the parcel without a tracking number. Canada Customs advised that the package could be in either Vancouver, Toronto, Montréal or Halifax, but without a tracking number nobody was willing to hunt for it in mounds of undelivered parcels.

An unnamed Swiss herbarium has found a way around risking such loss. We had occasion to request the type of *Lichenomphalia pararustica*, one of the European four-spored lichenomphalias, for comparative study. Because said herbarium is renowned for never answering e-mail requests, a physical letter was sent, with an e-mail follow-up 1–2 weeks later. When these went unacknowledged, unanswered and unfulfilled, a new written loan request was mailed, again followed by an e-mail follow-up. No reaction, now over 3 years.

Our best mail story deals with Greg Thorn's attempts to examine François Lutzoni's Duke University collections of this group. Permission was granted and a package sent off. Nothing arrived and enquiry revealed that the package had been returned at the border because the customs form was outdated. A new form was supplied, filled out and the package resent. Nothing arrived and enquiry revealed that it had been returned at the border again: the customs form was newer, but now an even more updated form was required. To shorten this story: the package travelled to Miami seven times, and Toronto five, with a side trip to Belgium, before reaching Greg in London, Ontario, four months after setting out. Belgium? Yes, the kind lady trying to mail it finally spoke to the manager in her post office, who asked that the package be brought to him, and he would take care of it personally. She had had similar problems with some hebelomas, destined for Belgium, and took both packages to the manager. Hence the manager-empowered trip to Belgium. The lichenomphalias have racked up so many frequent flyer points that on their return they may decide to spend the winter in Capri first, before thinking about a return to DUKE.

As Faye would say, never assume…

4. Mount Ignoble



forms a unique econiche within the Western Newfoundland Regional Forest Ecoregion, but one not uncommon on mountaintops, seashores and other exposed areas throughout our forests. Similar places, well within the tree line, bring arctic flora and mycota within reach of most of us.

Several glaciations have scraped away most of our soil, leaving only a thin layer, easy to lose. Imagine a forest fire raging across the land (set off by sparks from the Newfie Bullet, no doubt). Sheltered areas recover nicely, but exposed areas fare less well. Winds carry away the ash produced by a hot burn, losing much carbonaceous organic matter, and in the absence of vegetation to bind the remaining soil, most of it is washed away by rain and snowmelt. What remains, inadequate to nourish trees, becomes colonized by reindeer lichens and ericaceous heath plants. Fully exposed areas are laid bare right down to rock. It may take hundreds of years for the forest to creep back, if ever: a natural laboratory for pioneer organisms.

These become small pockets of subarctic to tundra habitat. **A** shows Mt Ignoble as seen by GoogleEarth. **B** shows the barren heathland part, colonized primarily by species of *Cladonia*, *Kalmia*, *Empetrum*, *Vaccinium*, and a few stunted and shrubby *Picea mariana*. **C** shows the most exposed area of bare rock, where all soil and turf has been washed off. Only arctic rock lichens grow here. Even in the thickest winter, the rock is usually blown bare, exposing everything to wind, cold, and sun. In cracks of this bare rock our small, brown mushrooms grow.

Comment: This arctoalpine species was first collected from Mt Washington, NH, part of the White Mountains of the Appalachian Range. Mt Ignoble is a low bump in the continuation of the Appalachian Range in Newfoundland. We also collected it on the nearby and similar Easter Peaks, and during the 2015 foray, on the Big Level (above Western Brook Pond) in Gros Morne National Park, where the Park arranged to take us by helicopter.

5. And where do we assume *Lichenomphalia velutina* fits?

Phylogeny has shown us that our mushroom is conspecific with *L. oreades*, and that *L. grisella* is its sister species. These names are based on verifiable fact, not assumption, because matching sequences were taken form natural tissue of type material. Of the known brown agaric lichenomphalias, only one species was described before these two: *L. velutina*. The question was raised, whether it is an earlier description of either species. That seems to be the current feeling, leading to its synonymization with *L. grisella*. Let us see what support we can find for this **assumption**.

Quélet was brief, when he first described *L. velutina*. He made no mention of growth in a mat of granular lichen thallus, and no mention of basidia or their sterigma count. Hence, so far, we have no indication that it is even a basidiolichen, let alone which of the two we know (**assuming** sterigma count is of genetic significance). However, Quélet also left behind a delightful drawing (Figure 1), which is the only type material currently available of the taxon. The ground at the base of the stem shows what could be a mycelial mat, or even a lichen thallus. An **assumption** of either or both seems reasonable, even if not provable.

The drawing bears a strong resemblance to our *L. oreades* in shape, hairy stem and lichen thallus at the base (Figure 2); the stem may be every bit as hairy (velutinous) as shown by Quélet (Figure3); even the dried specimen looks similar (Figure 4). Although we are not familiar with *L. grisella* in its fresh state, its description is similar. Thus, the drawing supports an **assumption** that *L. velutina* is a brown basidiolichen, but does not help us decide which one (**assuming** there are only two choices). Given that the only known difference between the two genetically distinct species is a difference in basidial sterigma count, neither protologue nor drawing offer any factual support to the currently fashionable **assumption** that

1 2 3 4

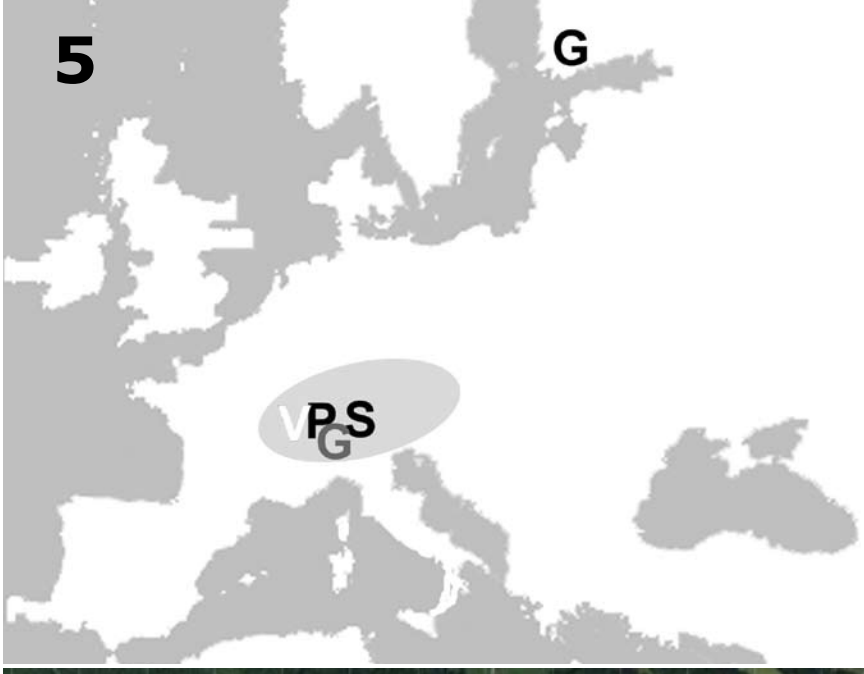
L. grisella is a later synonym for Quélet's species.

To our knowledge there are not two, but 11 described species that may fit this description. Type specimens for three of these species came from the European Alps (Figure 5, gray oval): *L. velutina* (Figure 5, white V), *L. pararustica* (Figure 5, black P), and *Omphalina subalpina* (Figure 5, black S). The last two are known four-spored taxa, and the type for the two-sterigmate *L. grisella* comes from relatively lush southern Finland, remote from the alps. (Figure 5, black G).

Considering this, the odds seem to favour an **assumption** that *L. velutina* might be a four-spored species, and not conspecific with the two-spored *L. grisella*. The **assumption** that the two species are not the same is weakly supported by the significantly different topography of their type regions: a pastoral landscape of some duration amidst a lowland forested region for *L. grisella* (Figure 6) and a harsh alpine setting way above the tree line for *L. oreades* (Figure 7). Both maps, taken from Google Earth, place what we suspect the most likely exact type location for each in the centre.

What would Faye say about such **assumptions**? No doubt she would urge caution, and suggest extensive collecting and sequencing, to reduce the amount of **assumption** necessary, before taxonomic changes are made. If all collections from the Alps (or even the Juras, where *L. velutina* was found) were to turn out four-spored and genetically conspecific, an **assumption** that *L. velutina* is that same four-spored species seems justified. Favre reported a two-spored basidiolichen from the Alps (Figure 5, gray G), so it is quite possible that both two- and four-spored taxa grow there. If both were collected, and/or more than one genetic species, deciding which one Quélet described on the basis of available evidence would be difficult, and it might be wiser to declare it ambiguous, due to inadequate information.

Even arbitrary decisions should not be made before knowing which species grow in the Alps. Imagine, how embarrassing it would be to declare now that ours is the same as species so-and-so from the Alps, and later find that subsequent extensive collecting failed to turn up a single example of that species.



6. *Lichenomphalia oreades*

Lichenomphalia oreades (Singer) Voitk, Thorn & I. Saar

MB 819711

Basionym: *Omphalina oreades* Singer *Pap. Mich. Acad. Sci. Arts Lett.* 32:123 (1948)

Macroscopic

Overall: Small, lichenized, brown basidiomycete found as pioneer species in arcto-alpine settings; cap diameter to stem length usually > 2 (cover photo and title banner).

Cap: 4–12 mm diameter, convex, usually depressed centre, becoming plane with down turned edges, margin crenulate; finely granular, striate, translucent, hygrophanous;light brown with yellowish tones, alternating with mid-brown striations.

Gills: Decurrent, almost triangular on side view, distant, often small lamellulae or forked at edge; light beige.

Stem: 4–20 × 1–3 mm, cylindric, often bent, partly below soil level, finely pubescent; mid-brown; base whitish tomentum directly associated with green algal granules, spread as mat.

Flesh: watery, pale brown, smell unremarkable.

Sporeprint: White.

Microscopic

(Figure 1—from mushroom shown in title banner)

Spores: 6.7–10.1 × 2.9–5.8 µm, Q_{av} = 2.0; elliptical to

Figure 1

allantoid, hyaline, vacuolar. More squat, granular spores also seen—these are presumed to be immature.

Basidia: 5–8 × 25–35 µm, hyaline, vacuolar, 4-sterigmate, 0–20% 2-sterigmate.

Cystidia: None.

Clamp connections: None. Note that the hyphal cells may be irregular with bumps, some adjacent to septa (dividing cell walls), at times giving the false appearance of clamps. However, careful examination will reveal that there are no clamps in any tissues, a characteristic microscopic finding for *Lichenomphalia*.

Hyphae: Incrusted brown pigment in cap and stem, occasionally elsewhere (not shown).

Habitat: Bare silicate "soil" in cracks of barren mountaintops., and turf at higher elevations.

Season: Last days of July to mid-November (Figure 2).

Ecology: Basidiolichen associated with algae (Figure 3). Sequencing identified *Chlorella ellipsoidea* and *Coccomyxa subellipsoidea*; either or both may be

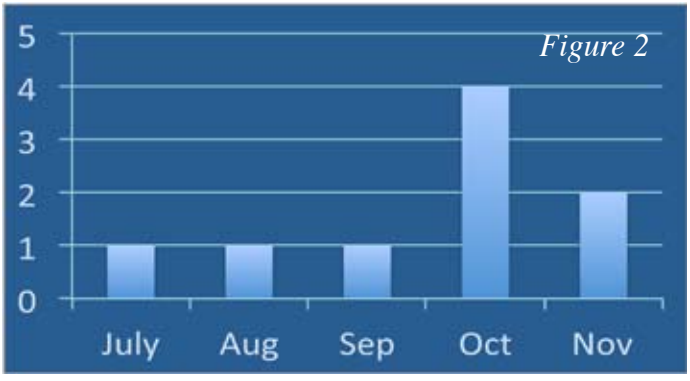


Figure 2

associated with this fungus. This adds a fourth agaric basidiolichen species to the three already identified here, in addition to three species of *Multiclavula* (see p. 15 for basidiolichens of NL).

Distribution: Arctoalpine. Extent unknown, both in the world and this province, where we only know it from Mt Ignoble and the nearby Easter Peaks, as well as Big Level in Gros Morne National Park.

Comment:

The major difference between this species and the commoner *Arrhenia* in the same habitat is the lack

of clamps. Both species may have hyaline (clear) or granular basidia and spores, but *L. oreades* also has those with vacuoles (structures appearing like bubbles). Both may have squat spores, but only *L. oreades* has elongated to allantoid (sausage-shaped) hyaline ones, twice as long as wide.

The presence of four sterigmata (spore-bearing projections) on the basidia separate this species from *L. grisella* (P. Karst.) Redhead, Lutzoni, Moncalvo & Vilgalys.

All descriptions based on our own observations. May differ elsewhere.

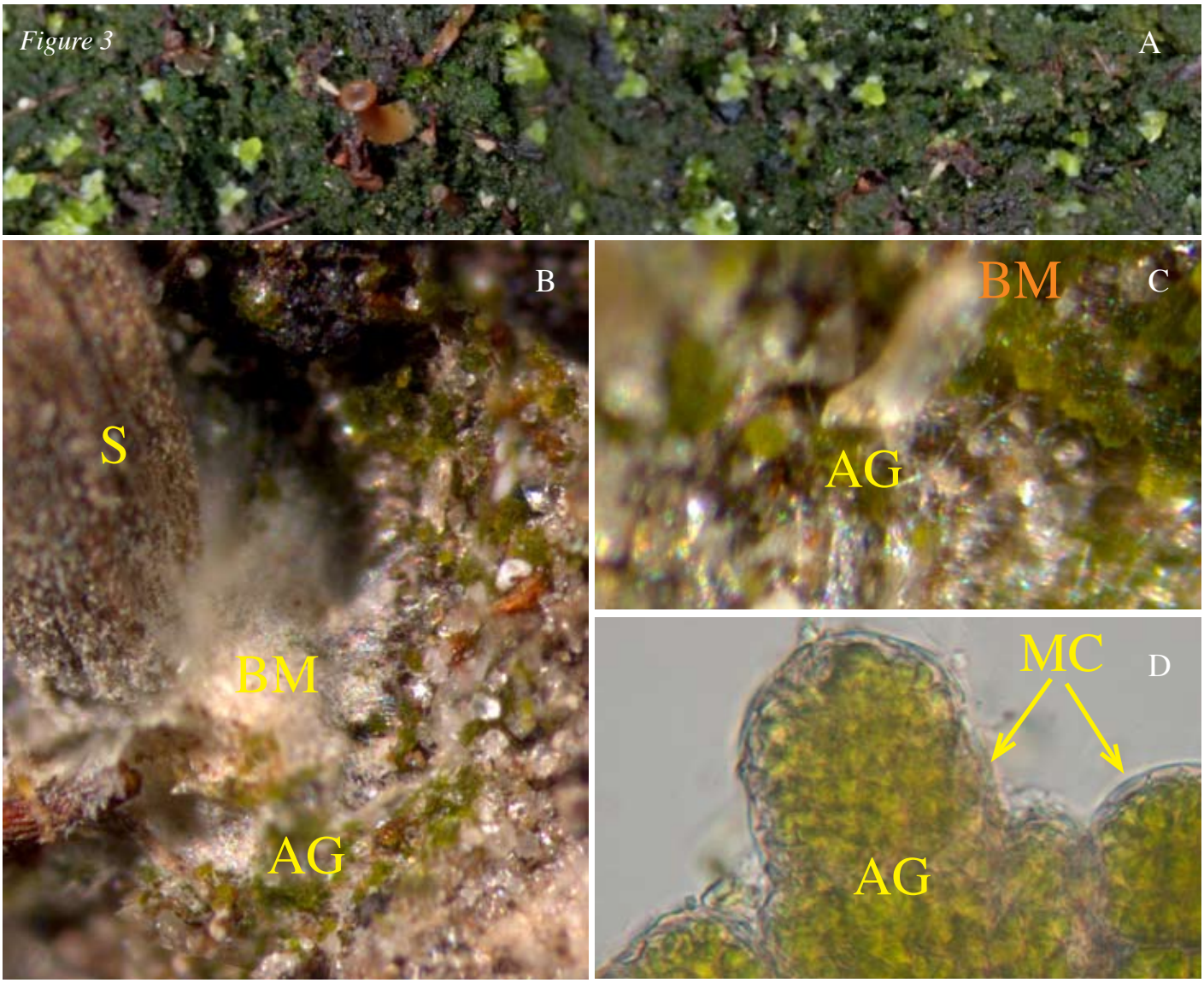


Figure 2. Lichenization

***A**: Mat of algal granules, interspersed with some moss buds. Compare this with the algae on the cover photo and title banner. Lush, thick mats of algae such as this one are not found in the exposed arctoalpine sites where* L. oreades *grows. This mat is associated with* L. umbellifera *in a more protected site. One small fruit body can be seen to the left.*

***B**: Stem (S) with white basal mycelum (BM) at bottom, into which are enmeshed green algal granules (AG).*

***C**: Magnified views of the algal granules (AG), intimately associated with the basal mycelium (BM), with larger hyphae coursing from granule to granule.*

***D**: Microscopic view of the algal granules (AG), containing individual algae, packed tightly together. Each granule is surrounded by a single layer of flat mycelial cells (MC). The tiled surface appearance is due to face-on views of the flat cells, not quite in focus (focus was set to show them in side view around the edges). Small mycelial strands can be seen running between algae, and larger hyphae coursing from granule to granule.*

7. The basidiolichens of NL


Lichenomphalia umbellifera


Lichenomphalia hudsoniana


Lichenomphalia alpna


Lichenomphalia oreades


Multiclavula mucida


Photo: Roger Smith

Multiclavula cornyoides


Multiclavula vernalis

8. Oreades

A note about the name. Oreades are mountain nymphs. Think small, cute pixies.

Or, try this: Les Oréades, William-Adolphe Bougereau, 1902. A great example of what can happen if your imagination runs away with you, when your mastery of the craft exceeds your mastery of art (or good taste). The Salon catalogue matched the painting in effusiveness: "… radieuse l'aurore paraît et colore d'une teinte rose la cime des monts … la troupe joyeuse des Nymphes … quitte la terre, et, sous les yeux des faunes étonnés, regagne sa patrie et les régions éthérées où habitent les dieux."

The imagination of Rolf Singer was perhaps a bit more civilized when, 46 years later, he gave the name oreades to the small brown mushroom on the Appalachian chain.

Web image in the public domain.

9. CLAMPS

who has them, what they look like, what they do

Because clamp connections have turned out to be so important in the identification of these species, let us use this opportunity to find out what they are. The photo in the title banner comes from the *Arrhenia* found atop Mt Ignoble. Arrows show the clamp connections, small bumps at the septa (cell wall divisions in a longitudinal hypha). These are the structures that made it clear that there were two species in that same microhabitat: one with these clamps, and one without. *Lichenomphalia* species do not have clamps at the septa.

Clamp connections represent a significant physiological development in the evolution of fungi. Most basidiomycetes have them. You and I carry our genetic material from our parents in a single nucleus in each cell. Fungi carry two nuclei per cell, one from each parent. When cells elongate to form hyphae, eventually they become too large for one control centre, and divide into two. To keep two nuclei per cell, both nuclei move to one end of the cell, as seen in the Wiki figure to the right. They then divide by mitosis. The nucleus from one parent moves to the other end, while that from the other parent moves into a small side-arm produced by the cell. This arm moves over the septum dividing the two cells. There, another septum forms to isolate it from the new cell, while the other end of the arm grows to join the original cell, and empties the nucleus there. Thus, we have restored two nuclei to each cell.

Because not all species have these structures, clamps become one of the microscopic characters we can use to identify mushrooms that defy identification by macroscopic characters alone.

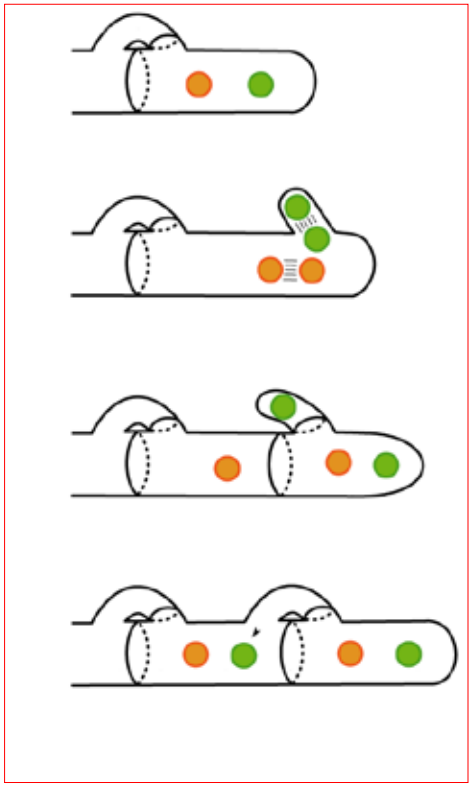


Image from Wikipedia, with permission:

Clamp_connections_updated.jpg: The original uploader was Jagriff at English Wikipedia derivative work: Tirithel (talk) - Clamp_connections_updated.

The lichens of Salmonier Nature Park

Yolanda Wiersma, Troy McMullin

How many lichens are there in Newfoundland?

Good question. Readers of Omphalina know that along with repeats of familiar species, each annual foray brings new species of mushrooms and lichens for the province, sometimes even to science. The contributions of the Foray to the mycological knowledge of the province have been well-documented. But how do scientists know when they've found everything? Why do some parts of the province have more species than others?

Eerioderma pedicellatum.

In a recent paper we published in the Journal of the Torrey Botanical Society[1], we documented the lichen diversity of a small corner of the province, Salmonier Nature Park (1,455 ha). This survey came about by the happy circumstance of Troy's being permitted to stay at the staff housing of the Nature Park, while doing survey work for one of Yolanda's projects. During down time from the main project, he wandered the trails collecting lichens, and also had a chance to go on an overnight expedition into the park's backcountry. We documented 137 lichen and allied fungi from 66 genera, including two species new to the island of Newfoundland (*Phaeophyscia ciliata* and *Stereocaulon subcoralloides*), six new to the province (*Ephebe hispidula*, *Muellerella lichenicola*, *Mycoblastus sanguinarioides*, *Placynthium flabellosum*, *Usnea flammea*, and *Xanthoparmelia angustiphylla*). One species,

Erioderma pedicellatum, is listed as "special concern" by the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and "critically endangered" by the International Union for Conservation of Nature[2,3]. We know we didn't find all of them: a comparison of our findings to previously published lists suggests there may be as many as 144 species from 67 genera in this one small park.

To put our findings in a broader provincial context, we compared our results to a recent publication on lichens in four provincial parks in the province by John McCarthy and colleagues.[4] We found a higher number of species than in the other parks. For example, 63 species were recorded in nearby Fitzgerald Pond Provincial Park, less than half of our findings in Salmonier. Survey effort (person-hours spent collecting) likely explains part of the difference, but even if we correct for survey effort, Salmonier shows higher lichen species diversity than the other four parks.

Is there something special about this park that promotes lichen diversity? Possibly. Yolanda's expertise in landscape ecology and biogeography allowed us to investigate the relationship between

Peltigera scabrosa.

Hypogymnia vittata.

Peltigera membranacea

Salmonier backcountry hut.

landscape diversity and park size to total lichen richness. With only five sites, we did not have enough power to test this statistically. However, the patterns we did produce, did not support the hypothesis. The park with the highest landscape diversity (Sandbanks) had only intermediate richness (63 species), similar to two other parks, one of which (Jipujikuei Kuespem) had the lowest landscape diversity.

We also compared how similarity of species composition varied with proximity by comparing overlap in species composition between the five parks. Fitzgerald's Pond, the park closest to Salmonier, had the highest overlap in composition, but the next highest overlap in composition was with Sandbanks, over 330 km away, as the crow flies.

Perhaps lichens do not follow the usual "rules" of landscape ecology or biogeography. Perhaps there are more microhabitats in Salmonier than the other parks, which aren't captured with the landscape data we used. Or maybe there are differences in survey methods. Nonetheless, we know we do not know all the species that are in the province (or even in Salmonier Nature Park, for that matter), which leaves room for more exploration and research.

References

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3. Scheidegger, C. 2003. Erioderma pedicellatum. Retrieved January 28, 2016 from IUCN Red List of Threatened Species 2003: e.T43995A10839336. http://dx.doi.org/10.2305/IUCN.UK.2003.RLTS. T43995A10839336. en.
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Metcalf's Falls.

OUR PARTNER ORGANIZATIONS

People of Newfoundland and Labrador:

- Department of Environment and Conservation
  - Parks and Natural Areas Division
  - Wildlife Division
- Department of Fisheries, Forestry and Agrifoods
  - Center for Forest Science and Innovation

People of Canada, through

- Parks Canada
  - Terra Nova National Park
  - Gros Morne National Park

The Gros Morne Co-operating Association

Memorial University of Newfoundland

- St. John's Campus
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Tuckamore Lodge

Quidi Vidi Brewing Company

FORAY NEWFOUNDLAND AND LABRADOR

2018 2018 2018 2018 2018 2018 2018 2018 2018 2018 2018 2018 2018 2018 2018 2018 2018 2018

The second decade

AVALON PENINSULA

(At least, that was the last I heard)

Exact location, tba

September, 2018, dates tba

GUEST FACULTY

Renée Lebeuf
Roger Smith
Greg Thorn
more tba

Get to know our MUSHROOMS & LICHENS!

See our website April/May, 2018, for Date, Place, Registration Forms & other information:

<www.nlmushrooms.ca>

Photo: Roger Smith