SOCIÉTÉ MYCONB SOCIETY

Newsletter

OF THE NEW BRUNSWICK MYCOLOGICAL SOCIETY

FALL 2023
VOLUME 2, ISSUE 1

INSIDE

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Clavaria zollingeri – Photo by Holly Jones

Help Us Name the Newsletter!

The newsletter has a new look and needs a proper name! But, we need YOUR help! Keep an eye out on our **Société MycoNB Society** Facebook group for a contest where you can suggest and vote for a name. The winning entry will become the new identity of the *MycoNB Newsletter*!

UPCOMING EVENTS & NEWS

SPECIAL LECTURE

Mushrooming: The Joy of the Quiet Hunt by Diane Borsato
NOVEMBER 15, 2022, 7:30 PM

Join via Zoom (Link in Member's Lounge at Myconb.org)

MYCONB SOCIETY WALKS

The last walk of the year was held on October 22, 2023. Society walks will resume in Spring 2024!

MEET OUR TEAM

PRESIDENT Jessika Gauvin
VICE-PRESIDENT Anthony Brooks
CHIEF SCIENCE OFFICER Alfredo Justo
SECRETARY Brad Robichaud
TREASURER Michele Fullarton
MEMBERSHIP COORDINATOR Jared Scratch
DIRECTOR OF SOCIAL MEDIA Holly Jones
DIRECTOR OF OPERATIONS Samantha Steeves
NEWSLETTER COORDINATOR Matthea Schumpelt

Special thanks to Kendra Driscoll for donating her time toward reviewing and proofreading the newsletter.

CONNECT ON FACEBOOK
Société MycoNB Society Forum (New Brunswick mycological society)

WRITE FOR THE NEWSLETTER!

The *MycoNB Newsletter* (new name pending!) is always looking for submissions! Topic ideas include (but are not limited to):

- Stories from MycoNB events
- Highlights on NB fungi
- Scientific processes related to fungi
- Personal accounts or stories related to mushrooming
- Poetry/prose
- Most interesting fungus you've found
- Recipes and tips for storing mushrooms

Send your submissions to **newsletter@myconb.org**

A Letter from the President

Dear members of MycoNB, mushroom lovers, friends,

As we prepare to close out the 2023 foraging season, we are so pleased to bring you another edition of our *MycoNB Newsletter*. We welcome the wonderful and talented Matthea Schumpelt as our new Newsletter Coordinator.

This year, MycoNB members contributed heavily to the seasonal Mycoblitzes; it was truly a pleasure watching you all participate. Mycology is a science that relies heavily on contributions from citizen scientists, so know that the work you do is so important in furthering the progress of one of the planet's youngest sciences!

In addition, our annual foray in October was a triumphant success: A giant crowd of mycophiles gathered in one space to celebrate our love of fungi and the natural world, and we look forward to what the next year brings.

Lastly, I'd like to say a gigantic thank you to our executive board, who has done a stellar job of pushing this organization forward with joy and passion in all our endeavours.

Jessika Gauvin
MycoNB Society President

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Photo by Jonathan Allport

From Solitude to Connection: Reflections on the MycoNB Society Annual Foray

MATTHEA SCHUMPELT | OCT 7, 2023

On the morning of the MycoNB Society annual foray, I stood at the entrance of Killarney Lake Lodge a little nervous and excited—like a teenager about to go on a blind date.

Like most mushroom lovers, I often spend hours in the woods hunting for fungi alone. My social skills, if left unused, grow awkward and clumsy with no one but the trees to watch me greet mushrooms and give them affectionate boops. But this year, I had made up my mind. Awkwardness be darned: I was going to this foray, social skills or not.

So I walked into the building alone and climbed the stairs to the meeting room. To my relief, there were a few early arrivers and Society team members huddled around a table with mushrooms on paper plates. *When in doubt, head toward mushrooms.*

From then on, it was easy. We oohed and ahhed at a just-found *Coprinus comatus* (Shaggy Mane). We marvelled at its graceful columnar stature and the ink just starting to ooze along the cap margin. We gently peeled apart the cap, just to check out the fascinating *deliquescing* (self digestion) of the gills. It was clear from the excitement and wonder we shared over this mushroom that I was among kindred spirits, and that today was going to be a *great* day.

Coprinus comatus - Photo by Eve Nielsen

Identification Table - Photo by Jonathan Allport

And it was! A large number of members attended, all eager to connect over our shared love of fungi. MycoNB Society experts shared their knowledge through informative lectures and Q&A on topics such as mushroom 101 for beginners, poisonous mushrooms, and *Hydnum* species in NB. (Details from Alfredo Justo's talk are in the *Hydnum* article in this issue.)

In addition, we spent a portion of the day foraging as a group in beautiful Killarney Lake Park and brought our finds back to the meeting room for identification. With so many people foraging at once, we certainly amassed a large collection of interesting specimens for study!

Sorting and identification time was hugely enriching, as it allowed us to examine and identify tables full of specimens in person with other mycophiles and experts at hand.

Some of the many mushrooms we found during the foray:

- *Amanita flavoconia*
- *Amanita sect. phalloideae*
- *Ampulloclitocybe clavipes*
- *Boletopsis sp.*
- *Catathelasma ventricosum*
- *Cortinarius spp.*
- *Craterellus tubaeformis*
- *Flammula alnicola*
- *Gomphidius sp.*
- *Hydnellum suavaeolens*
- *Hydnum spp.*
- *Hygrophorus spp.*
- *Hypomyces lactifluorum*
- *Lactarius camphoratus*
- *Lactarius pubescens*
- *Lentinus brumalis*
- *Pleurocybella porrigens*
- *Rhodocollybia butyracea*
- *Suillus ampliporus*
- *Tricholoma spp.*
- *Turbinellus floccosus*

This was far more expedient than my typical solo process of searching through field guides and online sources, and posting my finds one-by-one on a Facebook group. I think I learned far more in *one* day than I did *all summer* researching mushrooms on my own!

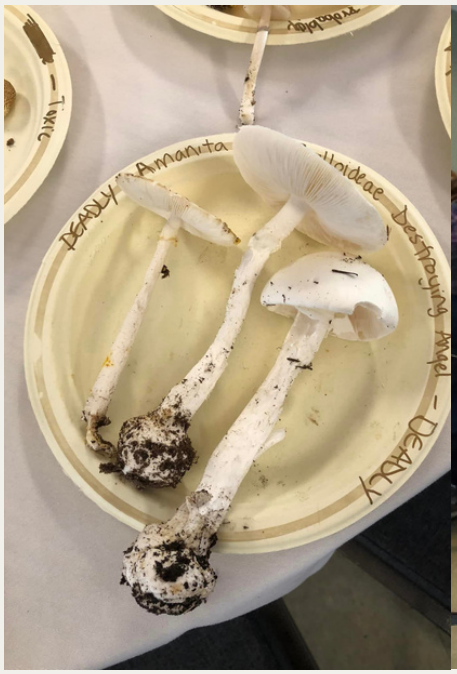
Lentinus brumalis - Photo by Holly Jones

What I learned from attending the foray is that the love I have for mushrooms was multiplied tenfold when shared with others with the same passion. It's rare that I get to nerd out about mushrooms with likeminded people for an *entire day*. How fortunate we are in New Brunswick to have our own mycological society to organize events such as this to support our learning!

So to the MycoNB Society team: Thank you for an amazing day. It was such a fantastic 'first date' that I somehow volunteered to be the new Newsletter Coordinator, so here I am—in a much more serious relationship than I anticipated!

Amanita flavoconia - Photo by Eve Nielsen

Have you joined the MycoNB Society yet?
Become a member at Myconb.org



Amanita sect. phalloideae - Photo by Eve Nielsen;
Society Members and Foray Specimens - Photo by Matthea Schumpelt

Annotated Checklist of Hedgehog Mushrooms (*Hydnum*) in New Brunswick

ALFREDO JUSTO | Curator of Botany & Mycology, Department of Natural History | New Brunswick Museum

The first issue of the *MycoNB Newsletter* included an overview of the ongoing studies of Chanterelles and Hedgehog mushrooms in New Brunswick (Justo 2022). This contribution presents the checklist of the 14 species of *Hydnum* that have been confirmed to occur in NB, with photographs and some brief notes on their morphological characters and distribution.

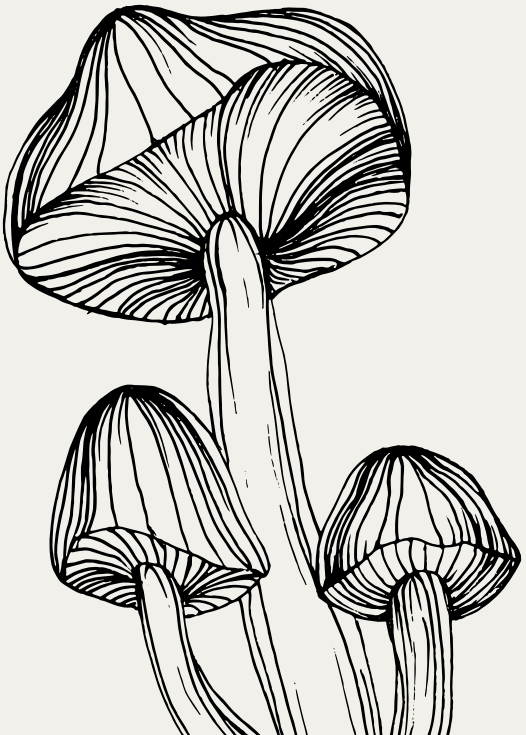
The results presented here are based on a one-year project carried out at the New Brunswick Museum during 2021–2022, and partially funded by the New Brunswick Wildlife Trust Fund. They also include some additional data from collections made during the 2022 mushroom season.

The checklist of species is presented taxonomically by subgenus, following the same classification used in the recent monographs by Swenie *et al*. (2018) and Niskanen *et al.* (2018). Detailed technical descriptions for the species mentioned there can also be found in these studies.

A full description of *Hydnum atlanticum* can be found in Justo *et al.* (2023).

Important morphological characters in *Hydnum* include:

- **Colours and size of the basidiomes (=mushrooms).** How big or small are the mushrooms? What is the colour of the cap, stem, and spines? Do they change colour when touched, damaged, or with age, and how quickly does that change occur?
- **Size and shape of the spores.** What is the length and width of the spores? What is the ratio of length to width, usually referred to as the "Q value" of the spores?
- **Number of sterigmata per basidium.** The basidia are the cells that produce the spores and are plentiful in the spines. Commonly, they have 4 projections (called sterigmata) where the spores are attached until they are released. In *Hydnum*, the number of sterigmata in an individual basidium can vary from 2 to 6.



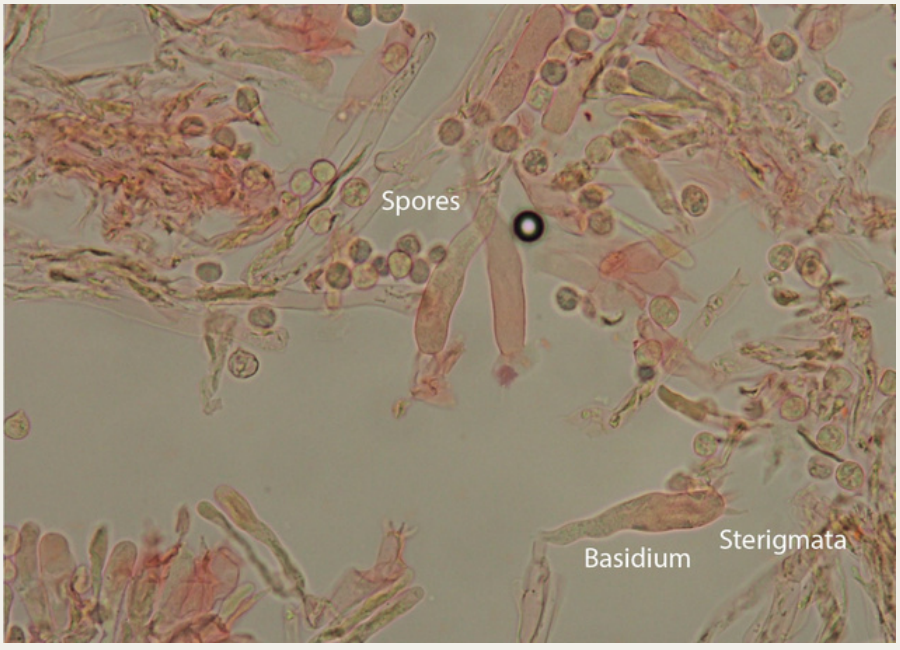


Figure 1. A basidium (pl. basidia) with 4 sterigmata, and spores of *Hydnum*.

***Hydnum* subgenus *Alba* Niskanen & Liimat.**, *Mycologia* 110(5): 896 (2018)

Includes species with mostly white or very pale-coloured basidiomes. Relatively small spores (on average less than 7 × 7 µm, that are mostly globose or subglobose (Q = 1.00–1.10).

***Hydnum albidum* Peck**, *Bulletin of the New York State Museum* 1(2): 10 (1887)

Small to medium-sized species (cap 20–60 mm in diameter), with overall white colours. The mushrooms turn very slowly yellow or yellow-orange after touch, or with age.

Widespread in Eastern North America, at least from Mexico to Atlantic Canada.

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/141087962
https://www.inaturalist.org/observations/123827933
https://www.inaturalist.org/observations/123725150

Figure 2. *Hydnum albidum*

***Hydnum alboaurantiacum* Swenie & Matheny**, *MycoKeys* 42: 45 (2018)

Very similar to *H. albidum*, differing in the basidiomes that are a little stouter, and that they turn orange much more quickly.

Described from Southeastern USA in 2018. First records of the species for Canada.

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/135983968
https://www.inaturalist.org/observations/123821948
https://www.inaturalist.org/observations/123818220

Figure 3. *Hydnum alboaurantiacum*

***Hydnum* subgenus *Pallida* Niskanen & Liimat.**, *Mycologia* 110(5): 899 (2018)

Includes species with pale-coloured basidiomes, usually intensely staining orange after touch or with age. Spores, slightly larger (on average more than 7 × 7 µm) than in subgenus *Alba*, and comparatively longer with average values of Q > 1.25.

***Hydnum subtilior* Swenie & Matheny**, *MycoKeys* 42: 48 (2018)

Characterized by the pale-coloured basidiomes and the rather elongated stature of the mushrooms, with a very long stem in relation to the diameter of the cap. All parts of the mushroom turn bright orange on touch or with age.

Described from Southeastern USA in 2018. First records of the species for New Brunswick.

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/123706097
https://www.inaturalist.org/observations/123728581

Figure 4. *Hydnum subtilior*

Hydnum subgenus *Hydnum*

Includes medium to large species (cap up to 10–15 cm in diameter), with pale cream to pale orange basidiomes, slightly staining orange after touch or with age. Spores larger than in subgenus *Alba* (on average more than 7 × 7 µm), and comparatively broader than in subgenus *Pallida*, with average values of Q < 1.25.

This subgenus includes all the species that used to be identified as *Hydnum repandum* in North America.

***Hydnum washingtonianum* Ellis & Everhart**, *Proc. Phila. Acad*. 1894: 323 (1894)

Characterized by the rather large basidiomes, easily reaching 10–15 cm in cap diameter and 2–4 cm stipe width in fully-grown specimens. Young specimens have distinctly orange colours, but the caps get progressively paler with age. Old,weathered specimens can appear almost completely white, but basidiome size would distinguish them from the white species in subgenus *Alba*.

Described from Washington (USA) in 1894, but the name was not widely used until the recent study by Swenie et al (2018), where DNA data from original collections was generated. This is the more common *repandum*-looking species in New Brunswick.

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/123824433
https://www.inaturalist.org/observations/123731829
https://www.inaturalist.org/observations/123710348

Figure 5. *Hydnum washingtonianum* (young specimens)

Figure 6. *Hydnum washingtonianum* (older, paler specimens

***Hydnum subolympicum* Liimat., Niskanen, R.E. Baird & Voitk**, *Mycologia* 110(5): 903 (2018)

Very similar to *H. washingtonianum*. The cap surface is more yellow-orange and often shows distinct cracking with age.

Described from Newfoundland (Canada) in 2018. In New Brunswick, currently known only from 2 localities.

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/136908697
https://www.inaturalist.org/observations/123724961

Figure 7. *Hydnum subolympicum*

***Hydnum vagabundum* Swenie, Ovrebo & Matheny**, *MycoKeys* 42: 52 (2018)

Very similar to the two preceding species. According to Swenie *et al*. (2018) differs from *H. subolympicum* in the "paler, more lobate pileus", but this difference would also apply to NB collections of *H. washingtonianum*.

Described from Texas (USA) in 2018. Widely distributed, from Honduras to Atlantic Canada.

The only New Brunswick collection was made by MycoNB vice president Anthony Brooks at Odell Park in Fredericton. There are no photos of the fresh mushrooms, but DNA analysis confirmed the identity of this collection.

***Hydnum* subgenus *Rufescentia* Niskanen & Liimat.**, *Mycologia* 110(5): 909 (2018)

This is the most diverse and complicated subgenus of *Hydnum*. Includes the intensely-coloured species, with brown, red-brown, or orange caps. A total of 8 species of this subgenus occur in New Brunswick, 4 of them can be recognized by a combination of morphological and ecological characters (*H. aerostatisporum, H. atlanticum, H. quebecense,* and *H. subconnatum*). The remaining four species (*H. umbilicatum, H. canadense, H. submulsicolor,* and *H. cuspidatum*) can only be reliably identified with DNA data.

***Hydnum aerostatisporum* Buyck, Lewis & V. Hofstetter, Cryptogamie** *Mycologie* 38:101–146 (2017)

This species is characterized by the bright and vivid red-brown, orange-brown colours of the cap. It forms relatively large mushrooms compared to other species of the subgenus (cap up to 10 cm in diameter). The cap surface becomes cracked and scruffy with age.

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/131654490
https://www.inaturalist.org/observations/130415075
https://www.inaturalist.org/observations/123703589

Figure 8. *Hydnum aerostatisporum*

***Hydnum atlanticum* Justo, A. Hood & Swenie**, *Fungal Systematics and Evolution* 11: 64 (2023)

This species is characterized by the rather muted, brown colours of the cap and growth on soil covered by S*phagnum, Bazzania*, and other bryophyte species. *H. quebecense* grows in the same habitats, often at the same time, but it has much brighter red-brown or orange colours, larger spores and basidia with 2 sterigmata.

Described from New Brunswick in 2023, based on the collections made during our 2021 project. Also known from New York and Labrador.

Reference *iNaturalist* observations in New Brunswick:

https://www.inaturalist.org/observations/123720261

https://www.inaturalist.org/observations/123711445

https://www.inaturalist.org/observations/123817573

Figure 9. *Hydnum atlanticum*

***Hydnum quebecense* Niskanen & Liimat.**, *Mycologia* 110(5): 912 (2018)

This species is characterized by the bright red-brown or orange colours of the cap and growth on soil covered by *Sphagnum, Bazzania*, and other bryophyte species.

Described from Quebec in 2018, widely distributed in Eastern North America.

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/123723679
https://www.inaturalist.org/observations/123711898
https://www.inaturalist.org/observations/123726508

Figure 10. *Hydnum quebecense*

***Hydnum subconnatum* Swenie & Matheny**, *MycoKeys* 42: 61(2018)

This basidiomes of this species are caespitose, with several mushrooms often fruiting fused to each other by the stems.

Described from the Southeastern USA in 2018. In New Brunswick, currently only known from one collection made at Odell Park in October 2022.

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/14031512

Figure 11. *Hydnum subconnatum*

Hydnum umbilicatum group

The species *H. umbilicatum, H. canadense, H. cuspidatum, and H. submulsicolour* are all characterized by small- to medium-sized basidiomes, with orange, brown, yellow-brown colours, and the cap with or without a central depression. *Hydnum umbilicatum* is the most common of the 4 species in New Brunswick, and *H. cuspidatum* is currently only known from one locality in the province. DNA sequences are needed for reliable identification of the individual species in this group.

***Hydnum umbilicatum* Peck**, *Ann. Rep. Reg. N.Y. St. Mus.* 54: 953 (1902)

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/123817994
https://www.inaturalist.org/observations/35133763
https://www.inaturalist.org/observations/141498712

***Hydnum canadense* Niskanen & Liimat.**, *Mycologia* 110(5): 908 (2018)

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/140833693
https://www.inaturalist.org/observations/123731336
https://www.inaturalist.org/observations/123730292

***Hydnum cuspidatum* Swenie & Matheny**, *MycoKeys* 42: 62 (2018)

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/123728796

***Hydnum submulsicolour* Niskanen & Liimat.**, *Mycologia* 110(5): 908 (2018)

Reference *iNaturalist* observations in New Brunswick:
https://www.inaturalist.org/observations/123720518
https://www.inaturalist.org/observations/123713909
https://www.inaturalist.org/observations/123820640

Figure 11. *Hydnum umbilicatum* group. A: *H. umbilicatum*. B: *H. canadense.* C: *H. cuspidatum*. D: *H. submulsicolour.*

Acknowledgements

This research was funded in part by the New Brunswick Wildlife Trust Fund (www.nbwtf.ca) under the project "*Biodiversity of chanterelles (Cantharellus, Craterellus) and hedgehog mushrooms (Hydnum) in New Brunswick (B001-228)*". Alexander Hood, Amanda Bremner, Kendra Driscoll, and Chris Webb helped with fieldwork for this project. Anthony Brooks, Denise Derrah, Dave Malloch, and Donna Monahan contributed collections.

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- Swenie, Rachel A., Timothy J. Baroni, and P. Brandon Matheny (2018) Six new species and reports of *Hydnum* (Cantharellales) from eastern North America *MycoKeys* 42: 35–72. https://mycokeys.pensoft.net/article/27369/

Mushroom Foraging Heuristics: Lessons from a Survey of Finnish Mushroom Foragers

ANDREW MACPHERSON

Have you ever wondered how mushroom foragers make safe yet quick decisions when identifying edible and poisonous mushrooms?

You may not even be aware of it, but we use heuristics in various types of situations. Put simply, a *heuristic* is an approach to problem solving that relies on a few relevant factors to arrive at a decision rather than evaluating the entirety of the evidence. These methods reduce the cognitive load involved in decision making. For example, a common heuristic from the field of medicine is "If you hear hoofbeats, think horses, not zebras," i.e., you should consider *common* conditions associated with a set of symptoms rather than *rare* ones. There are, of course, obvious drawbacks to such an approach: Dismissing everything as a horse means you're going to miss the zebra when it's there.

Heuristics also apply to mushroom foraging, which was investigated in R. O. Kaaronen's study (2020) of Finish mushroom hunters, "Mycological Rationality: Heuristics, Perception and Decision-Making in Mushroom Foraging." Finland was of interest because of its strong mushroom foraging culture with heuristics handed down from generation to generation. It is also less impacted by the rampant mycophobia evident in much of North America and has strong protections for foraging and exploration, summed up in the concept of *Jokaisenoikeudet* or "Everyman's Rights," allowing for untrammelled use of wild spaces (something sadly lacking in Canada).

For this study, researchers sought to evaluate how Finnish foragers make safe and efficient decisions in the field by identifying the heuristics centred around three subjects:

1. Rules of thumb for safe foraging
2. The identification of edible or poisonous mushrooms
3. The identification of good foraging patches for finding mushrooms

Commonly reported heuristics included:

- Only pick mushrooms you can identify with certainty.
- When identifying a mushroom, consult multiple information sources, including other people, books, and online communities.
- Completely avoid or be extra cautious with white mushrooms (due to similarity with Amanita virosa).
- Boletes (Boletales) can be identified by the spongy pores ("tubes") underneath their caps.

ARE HEURISTICS ALONE SUFFICIENT?

As such, many of those surveyed for the study pointed out that heuristics alone are typically insufficient for safe and successful mushroom foraging. Undoubtedly, heuristics that are centred on an arguable overabundance of caution (such as "avoid white mushrooms") will serve to provide a great deal of safety, especially for the casual forager. Given that the not insignificant risk of a false positive (identifying a toxic mushroom as edible) is death, it is important to minimize these events, even if that means heading home with an empty basket.

Amanita bisporigera and *Agaricus* sp.

At the same time, this approach puts many edible mushrooms out of consideration, limiting the options available to a forager. Given that the surveyed foragers do it for fun as much as for sustenance (86.9% vs 86.1%), foraging with these simple heuristics alone should be seen as a starting point and a useful tool, saving time and energy in the field.

> "... the study pointed out that heuristics alone are typically insufficient for safe *and* successful mushroom foraging."

And then there are some heuristics that simply won't work without a broader knowledge base backing them up. In Finland, for example, there is a fondness for pickled milk-caps (Lactarius spp.) with a corresponding foraging heuristic:

- Identify an edible mushroom, or specifically, an edible milk-cap (Lactarius sp.), by the latex ("milk") the mushroom exudes when cut. If it bleeds white "milk", the mushroom is judged edible (and if not, it might be poisonous).

A rule like this assumes that one can readily distinguish milk-caps or milk-cap-like mushrooms from others when, in truth, this rule is not useful in determining edibility. So, for heuristics

to be truly useful, they need to be complemented with more advanced skills, like pattern recognition and the knowledge to fully identify mushrooms.

LEARNING HOW TO MUSHROOM FORAGE IN NORTH AMERICA

In Finland nearly 40% of the population will forage for mushrooms in a given year, and of those surveyed, nearly 70% report learning at least some of the necessary skills from their parents. A sad reality in North America is that much of the traditional knowledge that may have existed around mushrooms has likely been lost due to ongoing colonialism and urbanization. This, combined with the aforementioned mycophobia, leaves foraging a skill for most of us to pick up on our own.

> "... for heuristics to be truly useful, they need to be complemented with more advanced skills, like pattern recognition and the knowledge to fully identify mushrooms."

The good news: This is not so great a challenge to overcome, even without a tradition of heuristics to inherit from our forbearers. We are blessed these days with a bounty of resources to inform our decision making and build our mushroom identification skills, which goes beyond just matching pictures. Some tips for expanding these skills include the following:

- Use reliable sources, both online and books in print. *Mushrooms of the Northeastern United States and Eastern Canada* and Mycoquébec.org are two excellent resources for New Brunswick fungi. Important note: Only purchase books from known authors as there have been a recent influx of AI-generated field guides sold on Amazon containing dangerous and deadly advice.
- Learn from experts and other mushroom hunters in your area. Consider joining your local mycological society (like Société MycoNB Society and its Facebook group).
- Consult experts and others on a local, regional, or international Facebook group.
- Keep a record of your finds. iNaturalist and Mushroom Observer are excellent tools for tracking your finds and contributing as a citizen scientist.
- Participate in a Mycoblitz. Getting DNA sequencing of collected specimens will increase your confidence in identification and contribute to our evolving understanding of fungal diversity.
- Train your senses of smell, taste, and other observational faculties. This means smelling—and yes—maybe even licking and tasting mushrooms through a nibble-and-spit test. Generally, it is safe to touch and taste all mushrooms as long as you don't swallow. Don't be afraid to get up close and personal with mushrooms; they won't mind!
- Familiarize yourself with all aspects of a mushroom: its environment, its associated plants and fungi, as well as its various stages of growth. Remember, the greatest treasure is nature itself. Spending time in the woods and fields offers invaluable insight into the mushrooms we love.

This process of learning takes time, but all you have to do is start with **one** mushroom. Get to know that mushroom by following the tips listed. Then, continue the process and get to know another, then another, and another, and so on! In time, you'll see your knowledge and skills expand, and with it, your ability to make safe and effective decisions in the field.

Reference:

Kaaronen, R. O. (2020). Mycological rationality: Heuristics, perception and decision-making in mushroom foraging. *Judgment and Decision Making, 15*(5), 630–647. https://doi.org/10.1017/s1930297500007841

Mixing With Myxos

Kendra Driscoll | Curatorial and Research Technician, Botany and Mycology | New Brunswick Museum

Recently, I took a small detour from my usual focus on lichens and allied fungi to work on a paper reporting collections of slime molds (aka Myxomycetes or myxos for short) held at the New Brunswick Museum (NBM).

The principal author, NBM research associate Virginia Zoll, had collected or identified the vast majority of the reported specimens, contributing substantially to our collective knowledge for New Brunswick.

Amanda Bremner, a fellow employee of the Natural History Department at NBM with a growing interest in myxos, took on the responsibility of corresponding author as well as the work of compiling the data into an appropriate format.

Meanwhile, other senior researchers at the museum were key to proposing the timing, scope, and appropriate journal for the paper.

As one of seven authors with but one identified specimen to contribute—a small member of the order Liceales occurring on a lichen—my role was small enough that I did not anticipate much to distract me. Yet as the process wore on, and I became increasingly involved in the writing and revisions of the piece, I found myself learning more and more about these amazing little organisms, and now I seem to see them everywhere I go. In my carefully considered scientific opinion, myxos are just plain COOL!

Below are some fun facts about myxos:

1. Despite frequent appearances in mycology textbooks and fungal collections (including NBM), myxos don’t belong to the fungi kingdom any more than mushrooms belong to the plant kingdom: They are closer to amoebas! (Discover Life)

2. Despite the name, the fruiting stage of a slime mold is dry and often very delicate, shaking out powdery spores at the slightest disturbance.

3. Myxos produce an astounding variety of fascinating forms and beautiful colours and textures, rivalling even the most celebrated groups of fungi as objects of interest to the eye (Figure 1 and 2).

4. >80% of the Canadian slime mold specimens were collected over 50 years ago (MyCoPortal), an indication of limited modern survey efforts. By contrast, the majority of Canadian mushroom records are less than 50 years old.

I will not soon abandon the lichens as a research subject in a quest to become a slime mold specialist, but I'm happy to read about them and look for them in the forest. Mixing with myxos is fun! I find myself collecting for science more and more often (safe in the knowledge that I can hand these on to Amanda and Virginia to identify). Considering the comparatively little attention these organism receive in biodiversity studies, there is plenty left to learn, and many more species left to find in NB.

As for the paper that started my distraction, it will be released soon in *The Canadian Field-Naturalist*, which I hope will be the first of many modern notes on New Brunswick myxos. Stayed tuned in to the Société MycoNB Society Forum Facebook group and NBM social media for news on that front. Happy hunting!

Figure 1. Stemonitis on a standing birch tree. Photo credit: Kendra Driscoll/NBM

Figure 2. a,b: *Ceratiomyxa fruticulosa.* c: *Physarum viride*. d: *Metatrichia vesparia.* e: Poroid form of *Ceratiomyxa fruticulosa* (formerly *Ceratiomyxa porioides*). f: Perichaena. g: *Arcyria denudata*. Photo credit: Amanda Bremner/NBM (a-d, f-g); Kendra Driscoll/NBM (e).

Funky Beans: The Fermentation of Coffee and Cocoa

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Fermentation in food is not normally associated with coffee and cocoa, but in fact, it can be a critical step for making the distinct flavours many of us love. Post-harvest processing by farmers plays a key role in quality of these luxury crops, and multiple types of fermentation can be implemented, most of which tap into wild native microflora including diverse yeasts and lactic acid bacteria. During fermentation, micro-organisms can add aromas, lower pH, and help to remove pulp before both cocoa and coffee beans are dried. Depending on the way beans are fermented, these practices can have just as distinct an impact as terroir, sun/shade, and cultivar. Coffee and cocoa are two very interesting plants that have put down roots (rimshot!) in different worlds, and in their new homes, people have tried different approaches to teasing a desired flavour out of the beans.

Cocoa, originating from Ecuador, Colombia, and Venezuela, now is mostly cultivated in West Africa (Cote d'Ivoire, Ghana), where 85% of global cocoa beans are produced, with the remainder produced in Indonesia, or choice high-end cocoa from South America. Coffee, an "Old World" crop originating from East Africa, has likewise moved production to the "New World", with Latin and Central America more often known for their coffee production rather than cocoa production.

However, cocoa fermentation would have first started in Mesoamerica where it was prized and, at times, used as a currency. West African farmers use the most simple traditional approach to fermentation of fresh cocoa beans, by harvesting collected cocoa pods and heaping beans covered in white sweet-smelling and fragrant pulp rich in sugars on banana leaves spread on the ground. This is easier said than done, and this whole process is labour intensive for farmers. But when you are finished, you have a heap the size of a small car, and it's starting to warm up and drip.

That's right: Just the *act of heaping* provides ample opportunity for the local microflora

waiting on the cocoa pod surfaces to leap into action on this rich, pulpy buffet, with almost immediate results. Temperature from microbial activity rapidly spikes to upwards of 60°C, while pH drops from acid production, and these two conditions activate bean enzymes to degrade in a process akin to malting. Over a

week, their enzymes are allowed to break the bean proteins down into fragments that, when roasted, give us the chocolate notes we all know so well. While bacteria generate the acids in this process, yeasts also produce aromas which the beans absorb, giving aroma notes ranging typically from floral (e.g., 2-phenylethanol [rose], linalool [floral]) to fruity (e.g., isoamyl acetate [bubblegum]). Interestingly these same chemicals are produced artificially and can be found in confections and personal care products, although there is growing interest in the industrial bioproduction of these molecules via yeasts instead of artificial methods. Regardless, the beans in the heap absorb these aromas, and these remain in the bean during drying, which then contribute to the final aroma, especially in high-end chocolate.

Something similar happens with coffee, but possibly to a less complicated extent (Just don't tell coffee farmers I said that. It's still complex, I promise.) In coffee production, a fleshy pulp needs to be removed from coffee cherries, and this is done in two ways: In "natural" or "dry" processing, cherries are spread in the sun to dry with pulp removed afterwards, leading to rich, full-bodied flavour. This is more prevalent in countries with hotter, drier climates such as Brazil or Ethiopia for example. Conversely, "washed" processes are more common in humid climates such as Colombia and Central America, where pulp is removed first, and then the beans are dried. However, before drying, a sticky remaining layer of mucilage (slime) remains, and this is where fermentation can come in. De-pulped beans can be stored in a tank of water for up to 48 hours, where—yep you guessed it—yeast and lactic acid bacteria produce acids and aromas while degrading mucilage. After drying, you have beans that are more acidic and floral, and new emerging fermentation techniques such as honey or anerobic fermentation intensify these flavours even further. Some handlers go so far as to add

specific yeasts to fermentations, and some isolates are closely protected proprietary strains. Many of these organisms can be isolated directly from the fermentation, and we can study how these multiple different players interact and work together to make those mouth-watering aromas we love so dear.

For those of you interested in developing a palate, seek out single-origin beans, which will often indicate the post-harvest processing if you are at a good roaster. Me? I roast my own green coffee beans in a popcorn maker and urge you to do the same. It's a tough life studying cocoa and coffee, but someone has to do it. Just thank the farmers who make this all possible, and act accordingly when buying your beans.

Yours truly,

Eric C. Peterson
International Scientist Extraordinaire

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Foodie Pharmacology Podcast
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Dr. Peterson's work on yeasts in coffee fermentation
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