The Nova Sclerotium

Spring 2022

scle·ro·ti·um : the hard dark resting body of certain fungi

Overview

Foray News!

Here are this year's Society foraying opportunities. Please check the

Society website for more details as they become available: https://www.nsmycologicalsociety.org/upcoming

Sunday September 25 - 'Fall Kick-Off Foray' at the Mull River Farm & Nature Centre, in Mabou *registration will be limited*

Saturday October 15 - The 'Big Fall Foray' at the Ross Creek Centre for the Arts, in Canning

November date TBA – On-line Virtual Foray

Editor's Note

Tom Clair

Here we are, Spring 2022 and a new mushroom season is upon us. With almost all travel restrictions removed, and the worse of COVID hopefully over, we can now move around and fully enjoy outdoor life again.

As a reminder of the good old days when we were all free to move around with no restrictions, we have an article by John Crabtree who dug out of his files, the rarest or most interesting of his finds in his years exploring the province. Mushrooms are such great subjects for pictures and John has captured some wonderful examples. Any other interesting finds that members have made would also find a home in this newsletter, by the way (hint to members).

An article in the first issue of Nova Sclerotium described a local company, Gourmet Mushrooms, which developed an operation supplying exotic mushroom for restaurants, growers, and consumers. In this vein, we were approached by another group which is setting up an operation to extract medicinal compounds from shelf fungi in Hants County. I thought what they were doing was pretty cool and interesting, so I wrote up an article on this fungal business startup.

Finally, useful and interesting fungi come in all sorts of sizes and functions. Adèle Bunbury-Blanchette, a Society member and a PhD student at Saint Mary's University, is studying wild fungi involved in converting grapes into wine in the Annapolis

Valley. She describes her work and its implications in an article in this issue.

So, another year and hopefully new fungi to discover and savor. However, make sure you forage safely. Nova Scotia woods are relatively safe but between getting lost and surprising a bear, you never know what you might run into. As a reminder, you might take a look on the Government of Canada's woodland safety booklet: https://www.gov.mb.ca/emo/pdfs/woods.pdf

Uncommon Mushrooms I Have Found in Nova Scotia

John Crabtree

Over my years of observing and collecting mushrooms in Nova Scotia, there have been a few where I seem to be the only one to either have seen them or recorded their presence. When asked by the Nova Sclerotium editor if I could pull out of my files the most interesting ones, I went through my pictures and found some that were never found during any N.S. Mycological Society Foray. Nevertheless, five of the seven fungi pictured below appear in a listing of "Fleshy fungi (Basidiomycota) of the Atlantic Maritime Ecozone" that was put together by Dr. David Malloch of the New Brunswick Museum. The two not included in the listing are polypores and as such are "not fleshy'. However they do occur in Gourley, C.O. 1983 An annotated index of the fungi of Nova Scotia. Proceedings of the Nova Scotia Institute of Science.

I have found all the fungi described below only once, with the exception of *Stropharia hornemanii*. This does not necessarily mean that they are rare or uncommon, as my searches were not as wide-ranging as I would have liked to provide a real idea of their presence in the region. For more on common and uncommon, I would direct you to "A little Illustrated Book of Common Mushrooms of Newfoundland and Labrador" by Andrus Voitk. When I added this book to my mushroom library I had no idea that Andrus and I had a shared experience when it came to "common mushrooms". This phenomenon can only be understood by people who have spent many, many years in the woods looking for them. Below, I describe those unique-to-me fungi which I found in my years going through the ecosystems of Nova Scotia.

Neoalbatrellus caeruleoporus, Blue pored polypore

Figure 1: *Neoalbatrellus caeruleoporus*

I had been aware of this rather beautiful polypore for quite a number of years and had searched for it in hemlock woods, where it has a mycorrhizal relationship. In early October 2012, I took a group of Young Naturalists and their parents on a mushroom hunt. Once in the woods the kids scattered off in all directions and eventually came back to me with their "finds". A boy of about 10 handed to me a mushroom that looked unfamiliar until I turned it over and saw that he had found *Neoalbatrellus caeruleoporus*. Sometimes, it's all about being in the right place at the right time, but being in a very large stand of hemlock trees doesn't hurt. About three years later, I was approached by a mycologist in Quebec who was studying *N. caeruleoporus.* He wanted me to send dried specimens to him, to which I gladly agreed. I knew exactly the place where it had been found before and went there on two separate occasions but unfortunately it wasn't there. So much for being in the right place at the right time and in the right habitat!

Aureoboletus russellii, Russells bolete

Figure 2: *Aureoboletus russellii*

I first saw this rather unusual bolete in late fall of 2014 when I paid my favourite oak tree a visit. In previous years, it had hosted a rather large specimen of *Grifola frondosa* (Hen of the Woods). The bolete was in an advanced state of decay, but it was instantly recognizable because of its long, skinny, ragged, and heavily fluted stem. This bolete is mycorrhizal with oaks and apparently with other hardwoods. It was in such bad shape that it wasn't even worth photographing. I made notes and took a GPS fix and decided to return the following fall, about two-three weeks earlier being about right. The following year, on the 4th of September 2015, I was rewarded for my patience. There was not one bolete fruiting, but seven beautiful specimens in a radius of about seventy feet or so. This bolete is rare in Nova Scotia being last reported about fifty years ago.

Sphaerobolus stellatus, Birds Nest fungus

Figure 3: *Sphaerobolus stellatus*

This is yet another find that I can attribute to my long term relationship with the Young Naturalists of Nova Scotia. In early October of 2020, I found myself, accompanied by Logan Gray, in the Mahone Bay area with the South Shore Young Naturalists. A lady, who was part of our group, brought over 'her find' for Logan and I to look at. Logan and I looked at it and neither of us had much of an idea what she had found. This fungus is extremely small being approximately 2-3mm

wide. It wasn't until several weeks later that I decided to take another look at the photos I had taken. Apparently *S. stellatus* is not uncommon in Nova Scotia, but because of its small size and growth habit it goes unnoticed. One of its common names is the Cannon-Ball fungus. This is unsurprising because it can shoot its periodoles two metres vertically and up to 6-7 metres horizontally.

Neofavolus alveolaris, Hexagonal pored polypore

Figure 4: *Neofavolus alveolaris*

I found this rather beautiful and unusual polypore in September of 2006. I remember that I found it in the Marshdale area of Pictou County and being very surprised by its unusual pores.

Hydnellum suaveolens

Figure 5: *Hydenellum suaveolens*

As I progressed through the woods in the fall of 2008, looking for something that would spark my interest, I smelled what reminded me of anise. Scouting around I came across a rather beautiful Hydnum that I had never seen before, and have not seen since. The identification was rather easy because of its colouring and the lovely smell.

Stropharia hornemanii

Figure 6: *Sphaerobolus stellatus*

I have found this mushroom on three separate occasions in 2004, 2010 and again in 2014. It is a striking mushroom with a wavy purplish veil and a rather scaly stem.

Lentinellus cochleatus, Cockle-shell lentinus

Figure 7: *Lentinellus cochleatus*

When I first saw this in 2005 it struck me that this was something very unusual with its saw edged gills. This is yet another mushroom that often smells of anise although when I found it I detected no smell whatsoever.

These are just a few of the rare to me fungi that I've seen over the last few years in the field. It's good to know that they are now documented and part of the record for the Province.

Growing Saprophytic Mushrooms for Medical Uses

Tom Clair

Fungi have been used in traditional medicines in Asia for at least 1000 years (Stamets 1993). For a number of reasons, the western world has not followed this pathway, but some research is now being done to isolate specific fungal compounds which have given some promise in dealing with human health problems. A review by Mendel Friedman (2016) of the US Department of Agriculture found that some chemicals in fungi are associated with bioactive compounds. β-glucans (homopolysaccharides) are believed to be the major bioactive compounds of mushrooms. Other types of fungal polysaccharides (heteropolysaccharides) also are known to possess biologically interesting properties.

Laboratory studies and small uncontrolled studies in humans show that maitake fungi (Hen of the Woods) extracts slow the growth of tumors and stimulate certain immune cells (https://www.mskcc.org/cancer-care/integrative-medicine/herbs/maitake). Another example of the use of mushrooms in cancer therapy is that Shiitake mushroom extracts are now prescribed in Japan to prolong the lives of stomach cancer patients undergoing chemotherapy (Ina et al. 2013). As there seem to be promising medical uses for these fungi, new work is now being done on this series of chemicals to better determine their efficacity and possible other uses. There is therefore a need to dependably access these compounds for testing and potential medical applications.

Julie Anne Lee DCH RCSHom opened Canada's first licensed holistic veterinary hospital in Vancouver BC and in her practice has used medicinal mushrooms in her protocols for cancer and autoimmune animal patients. She now lives in Pembroke, West Hants County and is the founder and formulator of the Adored Beast Apothecary (a natural animal supplement company) where medicinal mushroom formulas are currently sold. She also owns and operates an animal rescue farm.

As she has an interest in fungi as medicine, she has begun work with a team, trying to improve the quality and availability of these compounds for research and medicine. Her main idea is to improve on the growth and harvesting of fungi of interest under natural conditions, as opposed to controlled environments such as laboratories. She and her group feel that growing selected fungi on natural wood logs, outdoors and with the diverse microbiota and nutrient rich forest floor, would provide growing conditions more conducive to producing better quality polysaccharides and other constituents.

To pursue this idea, Julie purchased a selectively logged woodlot near her home, and with two colleagues, is working on ways to grow saprophytic shelf fungi under natural conditions, but in a more controlled fashion.

Figure 8: Julie Lee, with team members Nick Clement and Steve Poitras

To that effect, they've set up an outdoor area where they've cut trunks from various tree species which were inoculated with spawn from fungal species inserted in pre-drilled holes. The inoculate are protected from the elements with a covering of beeswax purchased from a local beekeeper.

This setup allows them to easily produce multiple trial combinations between tree and fungi species. Currently, the team is testing out Sugar Maple (*Acer saccharum*), Larch (*Larix laricina*), White birch (*Betula papirifera*) and Balsam Fir (*Abies balsamea*) trees in various combinations with Turkey Tail (*Trametes versicolor*), Lion's Mane (*Hericium erinaceus*), Shiitaki (*Lentinula edodes*) and Reishi (*Ganoderma lucidulum*) species.

Figure 9: Nick Clement with inoculated logs.

The field work is now in its early stages with the project design completed, logs inoculated and the spawn beginning to do its work. As growth of most of these species is relatively slow, it may be a few years before the research produces sufficient amounts to be commercially viable, but the group has also purchased the 100-year-old former Cambridge School House to set up as a laboratory to research other compounds.

Figure 10: Close-up of inoculated holes covered with bee's wax.

Figure 11: Reishi (*Ganoderma lucidulum*), one of the species being studied (photo N. Clement).

Julie believes that project like hers also to protect natural forest environments and have positive impact on air quality by absorbing carbon dioxide and moderating air temperature. She also is supporting the local economy by helping people make an income on their wood lots other than for clear cutting.

This work also shows that there is more to fungi than as food for humans and as the source of psychedelic experiences. Even tough, inedible shelf fungi may be the source of chemicals useful for medicine.

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Yeasts in Nova Scotian Wine Making

Adèle Bunbury-Blanchette

The microbial environment of grapes that have been freshly crushed to make wine ("must") is thriving and diverse. It is composed of fungi and bacteria that were present on the grape surfaces and within the grapes. Some of these microorganisms are good for the plant, like the fungal endophyte *Beauveria bassiana*, which may be present on aboveground portions of the plant but ultimately colonizes the roots to promote growth. Some of the microbes are plant pathogens, like the fungus *Erysiphe necator* which causes powdery mildew in grapevine.

In terms of winemaking, however, many of the most interesting microorganisms don't flourish until the grapes are crushed and fermentation begins. Briefly, fermentation is the conversion of sugar into carbon dioxide and alcohol and is completed by the metabolism of fermentative microorganisms. The most common fermentative agent is the yeast *Saccharomyces cerevisiae*, the same yeast used in baking for rise, and to brew most beers. Altough *S. cerevisiae* is usually found in low levels in must, it is often added to ensure fermentation, given its high efficiency in converting sugar to alcohol and tolerance to high-alcohol, low-oxygen conditions.

However, while *S. cerevisiae* eventually dominates most fermentations, whether it is added or not, it is far from the only yeast present in must. A community of diverse yeasts is actively interacting among itself and with other microorganisms in ways that will affect the characteristics of the wine. These "non-traditional" yeasts produce

compounds including alcohols, glycerol, and hundreds of possible volatile metabolites, that influence wine flavour, aroma, and texture. Although most of these yeasts will die off before fermentation is complete, some may persist and contribute throughout the entire fermentation.

Recently there has been a heightened interest in food and drinks that are produced locally, using "natural" methods or ingredients, which has coincided with the explosion of the wine industry in Nova Scotia. There are 23 wineries operating in Nova Scotia, 18 of which are new within the past two decades, and of those, 5 new in the past 5 years! Several of these wineries produce wines by means of "wild", or spontaneous, fermentation, in which the yeast *S. cerevisiae* is not added, allowing the fermentation to be completed by the unaltered grape yeast community particular to the vineyard. In this method, the diverse, non-traditional yeasts are not impeded by an early overwhelming presence of *S. cerevisiae*.

Despite the expanding wine industry and appeal of natural, local products, no research has yet taken place to characterize grape yeast communities in Nova Scotia vineyards. So, I have been working towards that end, in partnership with eight vineyards in the Annapolis Valley. My project aims to provide (1) baseline knowledge of local yeast communities on grapes to better inform spontaneous fermentations, and (2) inform opportunities to isolate desirable non-traditional yeasts for application in inoculated fermentations alongside, or in place of, *S. cerevisiae.*

Analyses have so far revealed a "core" yeast community that is common to the region, made up of species from the genera Aureobasidium, Bullera, Curvibasidium, Cystofilobasidium, Dioszegia, Entyloma, Filobasidium, Holtermanniella, Leucosporidium, Mrakia, Papiliotrema, Rhodotorula, Sporidiobolus, Sporobolomyces, Udeniomyces, and Vishniacozyma. Many of the species identified have potential useful applications in wine making and knowledge of their distribution could influence vineyard management. For example, some species of Filobasidium are uniquely associated with organic vineyards in Nova Scotia and may produce pectinases that could improve juice yields via increased breakdown of grape cells, or result in positive flavours and aromas in wine.

Figure 12: Wine yeast from pinot noir grapes in a petri dish

A shift to organic management could create an environment that would better support a population of Filobasidium for wine makers hoping to gain its specific contributions to fermentation. My project has also distinguished at least a dozen additional yeast species associated with organic vineyard management, vs three

with conventional management, and determined overall yeast diversity to be higher in organic vineyards. Other research groups have established that the sensory profile of wines produced from spontaneous fermentation depends on the diversity of the yeast community. Thus, an intent to incorporate spontaneous fermentation as a new technique may prompt consideration of modifying management practices to support greater yeast diversity in the vineyard.

Finally, my research also corroborates results from other Canadian regions in which *Saccharomyces uvarum*, as opposed to *Saccharomyces cerevisiae*, is not only common in spontaneous fermentations but can complete fermentation. If a vineyard manager wished to encourage fermentation by the unconventional *Saccharomyces uvarum*, they could take measures to decrease the opportunity for transfer of commercial *Saccharomyces cerevisiae* strains from the winery to the vineyard, e.g., a separate fermentation space for spontaneous fermentations.

For those wishing to experience the results of spontaneous fermentations, some of the Nova Scotia wineries that currently produce wines in this manner are L'Acadie Vineyards, Benjamin Bridge, Lightfoot & Wolfville Vineyards, and Sainte-Famille Wines – also look for the terms "wild fermentation" and "indigenous yeasts" on the labels!

Adèle Bunbury-Blanchette is a PhD candidate at Saint Mary University under the supervision of Dr. Gavin Kernaghan of Mount Saint Vincent University and Dr. Lihua Fan of Agriculture and Agrifood Canada.

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