The Potomac Sporophore

Winter | February 2020 Volume No. 35 | Issue No. 1

The quarterly publication of the Mycological Association of Washington, Inc. (MAW) | http://mawdc.org

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Featured Fungus: *Buglossoporus quercinus*

Thomas Roehl
Former Newsletter Editor

Editor's Note: This article originally appeared on Thomas' blog, Fungus Fact Friday. It is being reproduced here with his permission.

Buglossoporus quercinus is an interesting polypore that most of you probably haven't seen before. I've seen it only once myself, brought in at a mushroom club meeting. It reminds me of a yellow version of *Ischnoderma resinosum*. *B. quercinus* forms brackets that are fuzzy yellow on top with a white pore surface below. All parts of the mushroom stain brown when handled. The coloration and staining make it a unique mushroom. The Global Fungal Red List Initiative lists *B. quercinus* as "vulnerable" because it is rarely found and grows on only old oak trees – a habitat that is in decline across Europe. Although *B. quercinus* is primarily known from Europe, it was recently discovered growing in eastern North America.

Description

B. quercinus produces fan-shaped to roughly circular mushrooms on heartwood of living or recently dead old oak trees. The mushrooms are attached at a single point at the edge, so they may form a short stipe depending on how much space they have to grow. The top of the stipe or point of attachment is the highest point of the mushroom, with the rest of the pileus flat or curving downward. *B. quercinus* generally grows 15-20 cm across and up to 5 cm thick, although it can get larger. When very young, the mushroom's cap is whitish. However, it soon becomes yellow and covered in dense fuzz. The fuzz turns brown and flattens into a paper-like coating on older fruitbodies.

As the mushroom ages, it develops reddish hues and finally turns brown. On the lower side, the mushroom features a white pore surface with circular to slightly angular pores.

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Lynda Brynan Sears CC BY-SA 3.0

Buglossoporus quercinus is a polypore with a yellow top and white spore surface. You may find it growing on old oak trees.

Lichens: Part One

William Needham
MAW President

Editor's Note: This article is the first in a series of articles about lichens that will appear in Sporophore this year.

A lichen is "an association of a fungus and a photosynthetic symbiont resulting in a stable vegetative body having a specific structure" according to the definition accepted by the International Association of Lichenologists. On a lighter note, a lichen has been called a "fungus that discovered agriculture." The fungus provides structural stability, water and minerals and the alga provides complex carbohydrates. This close mutual relationship allows lichens to occupy extremely adverse environmental habitats that range from isolated rock outcrops in the frigid rarefied atmosphere at elevations over 6,000 meters to arid deserts devoid of virtually any other sign of life. Globally, there are about 14,000 species of lichens; 3,600 species are in North America.

In the most generalized sense, lichens are divided into five categories according to their basic morphology: crustose, foliose, fruticose, squamulose and leprose. Crustose lichens are the most familiar, as they are the tightly adherent crust-like growths typically found on any relatively old stone surface like a grave marker. Foliose and fruticose are the lichens that look like little leaves (*folium* is the Latin word for leaf) or little shrubs (*frutex* is the Latin word for shrub and has nothing to do with

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Mushrooms

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When touched, the mushroom's surfaces bruise yellow, then grey-pink, reddish, and finally red-brown. The mushroom's interior is white, fleshy to tough, and stains in the same manner as the fruitbody exterior. *B. quercinus* has an acidic smell and an acidic to bitter taste. I could not find information on the edibility of *B. quercinus*, but based on its unpleasant taste and texture, I would guess that the mushroom is not edible.

Ecology

B. quercinus grows only on old oak trees. It mostly appears on wounds in living trees where the heartwood is exposed. On rare occasions, *B. quercinus* can grow on younger oak trees with injuries that expose their heartwood. Sometimes, the mushroom fruits from logs and stumps of dead oaks. It seems to need a sufficiently large chunk of wood in order to grow since it never appears on branches. The mushrooms typically grow in summer and last a couple weeks to a month before decaying.

The fungus primarily lives in Europe, where it is widespread but rare. Outside Europe, its range extends into the Caucasus region of western Asia and there is a disjunct population in eastern North America. The Global Fungal Red List Initiative assessed *B. quercinus* as vulnerable to extinction because its habitat is decreasing across Europe. The group estimates that only about 500 suitable habitat sites remain and that number is decreasing. The main problem is that there is an age gap in oak trees across Europe: few old oaks remain and there are not enough middle-aged oaks to take their place. Consequently, the old oak habitat is being lost faster than it is being replaced.

The situation in North America is less clear. iNaturalist has 15 and Mushroom Observer has 19 observations of *B. quercinus* in North America, all distributed along the East Coast from the Great Valley eastward and from Roanoke, Virginia to just north of New York City in Connecticut. This area is primarily urban and suburban with some forested mountains and parks. Eastern North American forests were almost entirely logged in the past, so very old oak trees are rare in this part of the country. This suggests that the habitat range of *B. quercinus* is broader in North America than it is in Europe. North American *B. quercinus* can probably infect oak trees of varying ages. Consequently, the North American population of *B. quercinus* could be more resistant to extinction than the European population, which provides hope for the species' continued survival.

It's unknown when *B. quercinus* arrived in North America. The first public record in North America is from 2013 in Virginia. Within a year, the mushroom was observed in New York and Pennsylvania, which covers nearly all of its known North American range. Could *B. quercinus* have been introduced to North America from Europe? Possibly. Considering that its range has not significantly expanded since 2014, its introduction must have been a long time ago. Alternatively, it could be that *B. quercinus* is native to eastern North America. If so, it has an unusually limited range – based on similar species in the area, I would expect its range to encompass the Appalachian Mountains at least. Another unusual feature is the lack of historical records – a species as unique as *B. quercinus* should have been catalogued in North America much earlier. Therefore, it seems more likely that the fungus is not native to North America. However, a detailed study of *B. quercinus* DNA would be required to differentiate between the two hypotheses; a native population should have much more genetic variation than an introduced population.

Similar Species

Yellow polypores are not very common, so it should be relatively easy to differentiate *B. quercinus* from similar species. The most similar yellow polypore is probably *Phaeolus schweinitzii,* a polypore that has a fuzzy yellow pileus and stains brown when touched. However, *P. schweinitzii* has a yellow to greenish-brown pore surface and grows on conifers, making it easy to distinguish. Chicken of the Woods

(*Laetiporus* spp.) is another common polypore with an orange-yellow cap, but it does not stain when handled and has a wrinklier or more rosette-like appearance. In terms of overall shape, texture, and staining, *B. quercinus* most closely resembles *Ischnoderma resinosum*, which has a reddish-brown cap, white pore surface, and stains brown when touched. *Fistulina hepatica* (Beefsteak Polypore) is also similar in shape, but it has a reddish pileus, softer texture, a unique pore surface, and does not stain when touched.

Taxonomy

Until 1966, *B. quercinus* was known as *Piptoporus quercinus*. Many publications still use the older name. The name was changed because *B. quercinus* does not have the same type of hyphae in its fruitbody and does not produce long-lasting mushrooms. This differentiates it from the typical *Piptoporus* species, *P. betulinus*, which produces a white woody polypore that lasts most of the year. *Buglossoporus pulvinus* is another name you might see, but it is synonym of *B. quercinus*.

B. quercinus is in the order Polyporales, which includes most polypores. It belongs in the family Fomitopsidaceae, which also includes *I. resinosum*, the mushroom I think is most similar to *B. quercinus*.

The name *Buglossoporus quercinus* translates roughly to "ox tongue polypore on oak."

Two_Gnomes CCBY-SA3.0

Thomas Roehl

Upper: *B. quercinus*' stipe can be observed. **Lower**: the mushroom staining brown during handling.

Events Recap

Annie Greene
Newsletter Editor

Fall Mushroom Tasting

This year's Fall Culinary event was held on Oct 13, 2019 at the Sandy Spring Museum. The first-place prize went to Marisol Perez for her unique dessert recipe: Maple Syrup Cap Bavarian Cream! This custard dish was a favorite; the recipe can be found on Page 7.

Mushroom Fair

This year's mushroom fair was held on Oct 6, 2019 at Brookside Gardens within Wheaton Regional Park. MAW members educated the public about mushrooms with a microscope demonstration and a mushroom display table.

Lichen Walks

Two lichen walks led by Dr. Natalie Howe were recently held by MAW: a spooky Halloween lichen outing in Rock Creek Cemetery on Oct 26, 2019 and another in Carderock Recreation Area on Jan 25, 2020. Dr. Howe will be speaking about lichens at the monthly meeting on April 7th.

Upcoming Events

The events listed below may change, so read MAW emails and check our website at **http://mawdc.org** for up-to-date information on events. Exact foray dates and locations will be set closer to the event in order to take weather conditions into account.

Upcoming Scheduled Programs

Feb	4	**Monthly Meeting** featuring Tom Bigelow on crust fungi. Fungi in focus: Caterpillar Fungus (*Ophiocordyceps sinensis*), plus Hen of the Woods tasting (members only).
Mar	3	**Monthly Meeting** featuring Emily Bruns on rust and smut fungi. Fungi in focus: Fire-loving mushrooms.
Apr	7	**Monthly Meeting** featuring Natalie Howe on lichens. Fungi in focus: Best practices for cooking morels.
April		**Morel forays** start – look out for emails!

Save the Date

May	9	**Tentative Foray** in Front Royal, VA
Aug	21-22	**West Virginia Foray**
Sept	18-20	**Sequanota Retreat** in Laurel Highlands, PA
Oct	8-11	**NAMA Foray** in Potosi, Missouri

*Unless otherwise noted, monthly meetings will be held on the first Tuesday of the month at 7:00 PM in the **Kensington Park Library, 4201 Knowles Avenue, Kensington, MD**. Attendees are encouraged to bring mushrooms for sharing and identification. Members of the public are welcome to attend.*

Sequanota 2019

Annie Greene
Newsletter Editor

This year's annual Sequanota retreat was plenty fruitful despite a relatively dry fall season. Many species of mushrooms (108 to be exact) were collected throughout the weekend.

The retreat weekend kicked off on Friday September 29 with an afternoon foray at Shawnee State Park in Pennsylvania. This foray yielded some stinkhorns and stinkhorn "eggs" (*Phallus hadriani*).

Friday evening, participants arrived to the Sequanota Conference Center, about a 3 ½-hour drive northwest of Washington, DC. This first evening was a casual potluck/pizza dinner where mycophiles had the chance to mingle. After dinner, Ryan Deaver gave an interesting presentation about his experiences visiting Benin in West Africa and the traditional beer-making methods used there. Ryan also shared some of his home-brewed beer and discussed which yeast species are used in the craft brewing industry.

Saturday was the main day of the retreat, and attendees chose among several morning forays and several afternoon forays, some of which were on the Sequanota grounds and others were off-site. Jack-O-Lantern (*Omphalotus illudens*), Dog's Nose

Annie Greene

(*Camarops petersii*), and several types of honey mushrooms and puffballs were gathered.

After each foray, mushrooms were identified. The ID team, made up of Mitch Fournet, Shannon Nix, and several other MAW affiliates ensured all mushrooms were identified correctly.

Saturday evening, retreat attendees listened to several presentations. First, MAW's Programs Chair, Tom McCoy, gave a thorough overview of the area surrounding the Sequanota conference center. He discussed the flora, fauna, geology, landmarks, and history of the Laurel Highlands Region. Then, guest speaker Tim Baroni gave a presentation about mushroom species found in the NE United States, while mixing in some ID tips and entertaining anecdotes.

Annie Greene

Left: Foray findings with early fall foliage in the background. **Above:** Mitch Fournet reviews notable species found during the weekend.

After the presentations, John Harper and company cooked some of the mushrooms that had been collected during the forays.

On Sunday, attendees said their goodbyes and Mitch Fournet gave an overview of some of the most notable mushrooms that had been found over the weekend.

This retreat is a great chance to meet fellow mushroom-minded folks and learn about mushroom identification. Each foray is led by a seasoned identifier, and it's much easier to absorb ID tips from an experienced forager than from a book.

Many thanks to Tom McCoy, who organized the retreat and helped everything run smoothly. We hope to see you at this year's retreat, which will be held on September 18-20, 2020.

Song for Sequanota

(Excerpt)

By Robert Kilmer

To the tune of "Take It Easy" by the Eagles

"Well, I'm going down the trail, trying to fill up my pail.

Got three skally-wags on my mind.

One's an Amanita, a swarm of mosquitoes,

And t'other smells of turpentine.

Take it easy, take it easy,

Don't let the search for late morels drive you crazy.

Come on, baby, don't be lazy,

You know we'll find something tasty."

Fungi in the News

Annie Greene
Newsletter Editor

Editor's Note: This article contains summaries of the biggest fungus-related news from October 2019 through January 2020. Visit the link following each topic below for a closer look.

Body-snatching, fire-loving fungi

Some fungi only form visible mushrooms after a forest fire. These elusive species are called pyrophilous ("pyro" = fire, "philous" = loving) fungi. Researchers have long wondered where these fungi hide in the years, sometimes decades, between forest fires and how they manage to be some of the first organisms to rise from the ashes. A recent study conducted in Great Smoky Mountains National Park after a wildfire in 2016 found that between fires, many of these fire-loving fungi exist in endophytic or endolichenic life stages inside mosses or lichens - a habit that earned these fungi the nickname "body snatchers." Researchers used DNA evidence to detect these fungi. "Body snatching" may be a popular way that pyrophilous fungi stay alive between fires and eventually recolonize the forest floor after a burn. **Note: more information about these fascinating fungi will be presented at the March 3rd MAW meeting**. Read more at: **https://news.illinois.edu/view/6367/803853**

NASA is testing "myco-architecture" for space travel

NASA researchers are testing out the possibility of creating furniture and even permanent housing structures from fungal mycelium for use in outer space. If space travelers want to set up a permanent camp, on Mars for example, they must bring all their building materials with them from Earth. One way to lighten the load is to travel with folded up scaffolding containing dormant mycelium that, when water is added, grows to fill in the structure. NASA is considering a system that combines fungi with photosynthetic cyanobacteria, which would supply the fungi with sugar molecules for growth. Researchers are in the early stages of developing these types of materials, and they're also developing safeguards that ensure fungi from Earth won't contaminate outer space. Read more at: **https://www.nasa.gov/feature/ames/myco-architecture**

Common mycobiome yeast may exacerbate pancreatic cancer

A handful of bacteria and viruses are known to promote cancer development, and now a fungus has been implicated in cancer, too. Yeasts in the genus *Malassezia* are the most abundant fungus on mammalian skin, where they are typically part of a healthy mycobiome. Yet if they make their way into the pancreas via the digestive tract, *Malassezia* yeasts can promote cancer progression. This finding was based on samples from human cancers, as well as experiments in human cells and mice in the laboratory. Administering antifungal drugs helped boost the effectiveness of chemotherapy in mice with this type of fungus-driven pancreatic cancer. Future studies will help doctors understand more about the role of fungi in cancer and improve the effectiveness of cancer therapies. Read more at: **https://www.nature.com/articles/d41586-019-02892-y**

Deadly Asian fungus found in Australia for the first time

The poison fire coral fungus, previously thought to grow only in Japan and Korea, was recently found in Australia for the first time. This mushroom can be fatal if consumed, and can even cause skin irritation in those who touch it. This mushroom resembles bright red, finger-like corals, and its scientific name is *Podostroma cornu-damae*. The poisonous mushroom was found in a rainforest in Northern Queensland by an amateur mushroom photographer, who then sent samples to James Cook University for confirmation. It's not clear whether the fungus arrived recently or if it has been lurking in the Australian wilderness for years. Read more at: **https://www.bbc.com/news/world-australia-49916119**

Possible opioid alternative isolated from Tasmanian fungus

Researchers at the University of Sydney in Australia have isolated a compound from fungi that may be a useful tool to help fight the opioid crisis. The compound was isolated from a *Penicillium* species in an estuary in Tasmania. This peptide molecule has a unique structure that mimics natural pain-relieving messengers in the human body, and may be developed into a drug that treats pain while lacking the side effects and addictive potential of opiate-based painkillers such as codeine and morphine. More research is needed before this fungal-derived molecule can be developed into a drug and administered to humans. Read more at: **https://www.medicalnewstoday.com/articles/326715.php#1**

Fantastic Fungi documentary is a hit

A documentary called *Fantastic Fungi* has grossed over $1.6 million in movie theaters across the world. This documentary directed by Louis Schwartzberg features stunning images and time-lapse videos of mushrooms, plus as interviews with experts such as Paul Stamets, Michael Pollan, Eugenia Bone, Andrew Weil, and others. The film focuses on the potential of fungi to help remediate the planet, as well as heal the human body and mind. Read more or find a showing near you at: **https://fantasticfungi.com/**

Lichens (Continued)

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fruit). The last two are essentially variants of the crustose variety; squamulose lichens are crust-like with upturned scales (a squama is a scale) and leprose lichens are crust-like with a loose powdery surface. There are also combinations of these basic types; most species of the genus *Cladonia*, such as the pebbled pixie cup lichen (*C. pyxidata*) pictured at right, and the British soldier lichen (*C. cristatella*) are squamulose-fruticose, as cone-like fruticose protuberances extend from the scaly squamulose substrate.

The basic functional structure of a lichen is relatively simple. The fungal portion, called the mycobiont, constitutes the bulk of the thallus, or vegetative body; the algal component, or photobiont, provides photosynthetic energy. This relationship is generally characterized as benign mutualism, a type of symbiosis in which both constituents benefits from the association. However, it is probably better to characterize the relationship as at least partially parasitic, for in virtually every case the fungus penetrates the alga and absorbs about half of its nutrients; the survival of the lichen depends on the alga replenishing lost cells through photosynthesis. However, it may be characterized, the lichen relationship is very successful; there are about 20,000 species of fungi that exist only as lichens, about 20 percent of the known fungi population. None are found without their symbiotic partner in the natural environment, though they can be produced in the laboratory when isolated under axenic conditions.

Almost all lichenized fungi are in the subphylum Ascomycotina; the ascomycetes are called cup fungi because their spores are contained in a structure called an ascus that is typically shaped like a cup. There are 12 orders in Ascomycotina that are almost wholly comprised of lichen-forming fungi. Only two percent of lichenized

William Needham

Above: *Cladonia pyxidata*, the pebbled pixie cup lichen.

fungi are in the subphylum Basidiomycotina; the basidiomycetes include the umbrella-shaped gilled fungi more generally called mushrooms. In either case, the body or thallus of the lichen is divided into four distinct layers, three fungal and one algal. The top layer is called the upper cortex and consists of tightly packed fungal filaments called hyphae that protect the lichen from the environment and may be pigmented to shield against specific damaging light spectra. The algal layer is just under the upper cortex and is permeated by the hyphae of the third layer (medulla) which is comprised of loosely woven hyphal threads. The lower cortex is the bottom layer with specialized structures called rhizines that attach to the substrate the particular lichen species is adapted to, including rock, tree bark, and soil.

Unlike the diversified mycobiont associates, 90 percent of all photobionts come from only three genera, *Trebouxia*, a unicellular green alga genus, *Trentepohlia*, a filamentous green alga, and *Nostoc*, a cyanobacterium. Cyanobacteria were once known as blue-green algae; general statements concerning "algal" lichen constituents are therefore semantically, if not technically correct. Relatively recent changes to taxonomy resulted in the transfer of the blue-green algae from the Plant Kingdom to the Eubacteria Kingdom, since they are really bacteria and not algae. Their taxonomy is not yet settled; bacteria are prokaryotes - they have no nucleus, which distinguishes them from the eukaryotes, the cells of plants, animals, and fungi that do have nuclei. Cyanobacteria do not have the chloroplasts that carry out the photosynthetic process for the green algae but rather have chlorophyll throughout the cell fluid; their chlorophyll manufactures glucose that is used by the fungus. Cyanobacteria also have the relatively rare ability of nitrogen fixation; they produce structures called heterocysts that synthesize nitrogenase, the enzyme that transforms the gaseous nitrogen in the air to the monatomic atom necessary for the growth of living cells. Lichens that have cyanobacteria as their photobiont can thus survive in environments devoid of any soil nutrients.

The flow of nutrients between the mycobiont and the photobiont is the essence of the quasi-parasitic relationship. The mycobionts have specialized structures called haustoria that penetrate the cells of the alga. In the photosynthetic process, the green alga photobionts produce sugar alcohols; *Trentepohlia* produce erythritol, *Trebouxia* produce ribitol, and *Nostoc* produce glucose. These nutrients are transported to the fungal cell where they are turned into mannitol, a sugar alcohol widely found in fungi as a storage product. Because of the penetration of the algal cell by the fungus, sugar transport and conversion occur quite rapidly, often in under two minutes. It is also hypothesized that the alga provides vitamins to the fungus, notably biotin and thiamine. The role of the fungus in the relationship is not as well defined. It is highly efficient at absorbing water vapor from the air, so much so that at high humidity levels,

the algae photosynthesize at nearly their maximum rate. The fungal component also synthesizes a number of unique organic compounds, some of which are chelating agents that bind to metal atoms, thus providing a source of minerals to the alga.

Lichenized fungi produce spores in essentially the same manner as non-lichen fungi: the ascomycetes produce ascospores in the asci and the basidiomycetes produce basidiospores on the basidia. The only essential difference is that the slow growth of the lichen results in slow spore maturation. The released spores face another difficulty - in order to become a lichen, they need to find the appropriate alga with which to combine. Attempts to grow lichens with appropriate fungal spores and algae in the laboratory were unsuccessful until it was discovered that this could only be achieved when the two components were incubated in a low-resource, stressful environment - i.e. when the fungus and the alga needed each other to survive. There is a low likelihood of lichen synthesis under natural conditions due to the paucity of spores and a concomitant low probability of an encounter with a complimentary alga. The ubiquity of lichens cannot be therefore explained according to normal sexual regeneration. Not surprisingly, opportunistic lichens evolved vegetative regeneration, a form of asexual reproduction in which portions of the existing growth (vegetation) provide the genetics for replication. However, rather than a piece of the lichen thallus (containing both algal and fungal cells) breaking off and starting a new growth, it is more common for the lichen to form specialized structures that contain undifferentiated cells of each constituent. There are a number of different vegetative reproductive structures that are employed to this end: *soredia* consist of tangled hyphal strands that enclose several algal cells; *isidia* are extensions of the lichen thallus that can be cylindrical, spherical, or branched; *schizidia* are flakes that detach from the surface of the thallus; *lobules* are rounded lobes that form on the edges of the thallus. In every case, the fungus and the alga are transported together to a new location where, if environmental conditions are favorable (which means unfavorable to other competing species like moss), they will form a new colony.

Editor's Note: Part two of this article will appear in the next issue of Sporophore.

Maple Syrup Cap Bavarian Creme

A unique custard-like dessert flavored with dried Maple Syrup Cap mushrooms.
Editor's Note: This is Marisol Perez's recipe for her dish that won first place at the Fall Culinary event.

Ingredients

1 ½	Cups	Heavy cream
1	tsp	Dried, ground Maple Syrup Cap (*Lactarius helvus/aquifluus*) or Candy Cap (*Lactarius rubidus/rufulus)* mushrooms
3	Tbsp	Cold milk
1	Tbsp	Clear, unflavored gelatin
1/4	Cup	Sugar
1	pinch	Salt
5		Egg yolks
1 ½	Cups	Whipping cream

Directions

1. Heat the heavy cream on medium and add the dried ground mushrooms. Make sure the pot does not boil. When it starts bubbling, remove from the stove.
2. Dissolve the gelatin in the cold milk.
3. Mix the egg yolks with the sugar and pinch of salt until creamy.
4. Add the gelatin to the mushroom cream and mix well.
5. Add the gelatin-cream mixture to the egg yolks little by little, mixing well.
6. Heat the mixture on medium until its thick enough to cover the back of a spoon (nappe consistency).
7. Remove from stove and let cool.
8. Meanwhile, whip the remaining cream and mix together with the other cooled cream mixture.
9. Refrigerate at least 2 hours or overnight. Enjoy!

Tales of the Fun Guy

by Loretta E. Chi