# MushRumors

Newsletter of the Northwest Mushroomers Association

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## A walk in the woods, Amanitas in the mailbox Christine Roberts

*Amanita aprica* is a spring and early summer fruiting *Amanita*, spotted by Erin Moore in some abundance on the summer solstice in old, mixed forest in the Lake Wenatchee area. Photo (California specimens) courtesy Richard Morrison.

In mid-June I took a walk through the nearby woods and found about 10 billion *Marasmiellus peronatus* (formerly *Gymnopus peronatus*) in varying stages, from dried up (last year's, maybe) to fresh ones. A more delightful find was a whole tribe of bright orange *Hygrocybe miniata* then, towards the bike trail, a larger redder version of the same, plus also several tiny Galerinas on a mossy log. These I shy away from trying to ID as there are rather a lot of them on Matchmaker; still, their bright orangey-brown amidst the lush green moss caught my eye. I also spotted a bolete of some sort under a log: it was rather decrepit and as a large slug had glued itself underneath—having eaten most of the identifying features—I left it so that the slug could peacefully finish the rest. Sadly my oyster mushroom logs had ceased production for a while (sigh!) after a prolific spring. Also, on a big old log were several patches of slime molds, still white—so I'll have to remember to check those when they mature some—plus a blob about 4 cm across of a bright yellow slime mold that I'll also have to wait to see if it does anything else.

On returning home, I found a parcel in my mailbox: *Amanitas of North America* (by Britt A. Bunyard and Jay Justice, The Fungi Press, fungimag.com). First inspection showed pages of beautifully photographed Amanitas from all parts of the United States, very handy if you travel around the country. There are chapters on the uses of Amanitas, culinary and otherwise, and their toxicology, ecology, and other assorted information, which will take some time to peruse. But I think this book will be a useful addition to anyone's library. There is a key to groups, chemical tests for toxins, fairy tales, soma myths, famous poisonings, edibility information, and interesting asides. A great gift for the bibliomanic and nice for your coffee table or lab.

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## When more is less: Fungi and climate change Erin Moore

On mushroom forays, we squirrel away observations about mushroom species and habitat, companion plants, elevation, and timing. Year after year, that information becomes key to where and when we choose to head into the woods.

While anecdotal evidence gained through the hunt is powerful, it is also unreliable. So I wondered what science had to say about climate change and its effects on mushrooms.

To get a sense of fruiting patterns, researchers analyzed half a century of mushroom records in southern England. They found that in the 1950s fungi fruited over a period of around 33 days—but by the early 2000s this period had more than *doubled* to nearly 75 days. Mushrooms are now fruiting significantly earlier and for a longer period than ever before [Ed. note: hover and click over blue text for hyperlink].

These differences mirrored changes in British temperatures. An increase in late summer temperatures and autumn rains caused early season species to fruit earlier and late season species to continue to fruit later. Climate warming also seemed to have caused significant numbers of species to begin fruiting in spring as well as fall. It is interesting to compare this information with what we are seeing in Washington State (for an example of a reliable "fall" mushroom observed fruiting this summer, see photo of shaggy parasol, page 14).

But what might climate change science say about forest fungal health and diversity? A recent study from Stanford researchers found that climate change could by 2070 eliminate more than a quarter of ectomycorrhizal species inside many North American conifer forests. Says Kabir Peay, lead researcher, "One of the things that's kind of shocking and a little bit scary is that we predict there will be some pretty significant decreases in diversity in western North America, well known culturally for fungal diversity and for people who are interested in collecting edible mushrooms." We know that many fine edibles are ectomycorrizal—and therefore obligate fungal associates—of trees. By mapping the associations between trees and symbiotic microbes around the world, the Peay lab found perhaps not surprisingly that climate is "by far the most important predictor of contemporary fungal diversity patterns across North America."

Ectomycorrhizal fungi like *Boletus rex-veris* buffer forests against climate change. They protect fine roots, help stabilize soils, increase nutrient uptake, and enable trees to grow more quickly and fix and store more carbon: good for the planet.

Global warming changes all aspects of our lives, including forests and fungi. Working to reduce and mitigate those drastic changes is a worthy goal.

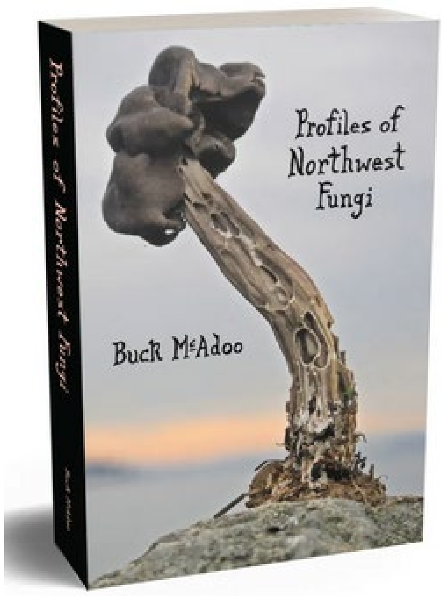
# Celebrating the big book of Mushrooms of the Month

When Christine got home one night in July after a walk with a friend she found a much-awaited book waiting for her on her front porch. *Profiles of Northwest Fungi,* by our very own Buck McAdoo, with contributions by Fred Rhoades, Richard Morrison, Tillman Moore, Christine Roberts, Sam Leathers, and Chas Gilmore, is a comprehensive collection of years of Buck's "Mushroom of the Month" articles written for the NMA newsletter. This edition is also an affectionate account of people and places who have been part of the Northwest Mushroomers Association's three decades of existence. The book is beautifully illustrated in color with mostly Buck's photos as well as some by Richard Morrison, with little mushroom designs by Dan Digerness dotted throughout, and an overall design and dust jacked designed by Buck's son Alex McAdoo. In *Profiles of Northwest Fungi* Buck has compiled his writings over the years and updated, edited, clarified, and unified the information and the references used—including modern name changes, of which there have been plenty.

This remarkable book features one hundred species and their look-alikes, ranging from *Agaricus augustus* and *Agaricus buckmacadooi* (indeed, named after Buck by Richard Kerrigan) to *Xylaria curta*. Parts II and III include "The Fungi Less Known" (such as "That Enigma from Icicle Canyon"), "...fungi that I have encountered over the years that may or may not be species new to science," and (to make sure you are feeling cheerful) a selection of "April Fool Mushrooms."

The book is published by Cameron Powers, www.gldesignpub.com, and a limited number of copies are available for $54.95, well worth the printing costs for this 500-page volume. It is also available at smile.Amazon. Get yours!

Buck McAdoo discovered mushrooms after first moving to the PNW years ago, and we thank the great underground World Mushroom for him doing so. In this book we all benefit from his delightful Mark Twain–like wit, and his insight, wisdom, photo files, and passionate research into Northwest fungi. This is the book to sit down with on a long summer's day, dreaming of fungi. —*Christine Roberts and Erin Moore*



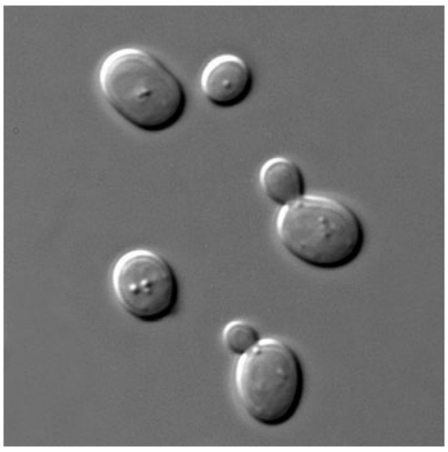

Author Buck McAdoo, middle, on a mushroom foray near Cle Elum Ridge in 1985, with Dan Digerness to the left and Roger Phillips to the right. Photo by Nicky Foy

Mushroom of the Month *Amanita phalloides*; these specimens were some of the first spotted in Bellingham, fruiting on the Western Washington University campus. Photo by Buck McAdoo

April Fool mushroom *Ganoderma immotum*, a "a rare polypore that prefers maple to conifers in the Pacific Northwest."

# Is it a fungus? Eric Worden

Sometimes we curious mushroomers come upon a strange-looking thing that we think might be a fungus, but we just aren't sure. Below is a sample of curious things, and here's your challenge: which of them are fungi and which are not? Try your hand! And find the correct answers on page 10.



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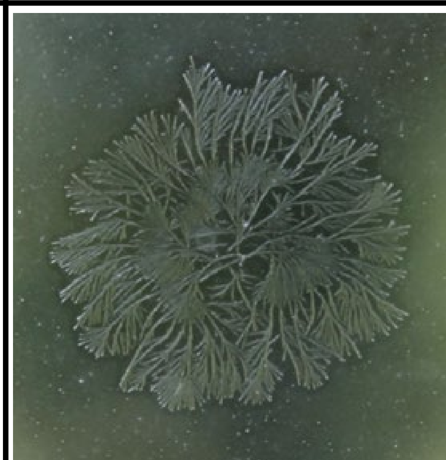

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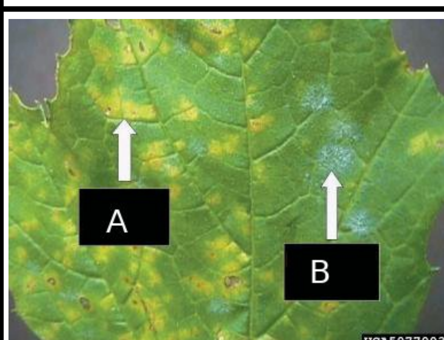


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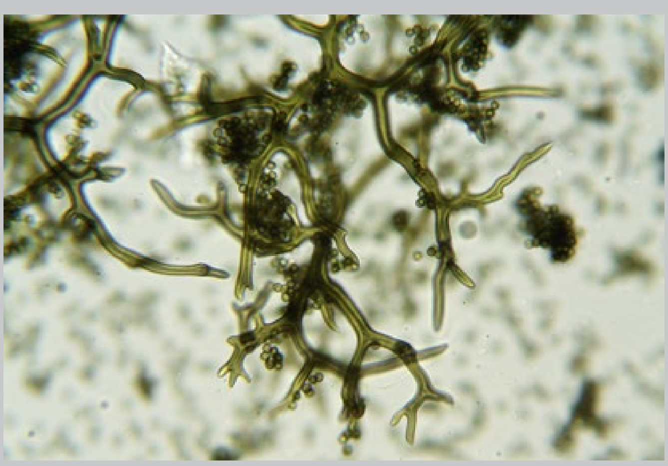
# Nine mushroom oddities from the NMA files

Richard Morrison, Buck McAdoo, and Fred Rhoades

*Nature sometimes produces odd or abnormal forms in the mushroom world. Some are rare growth abnormalities or mutations and seldom seen again, some recur periodically, while others are the result of attack by parasitic fungi or other types of organisms. The following are nine mushroom oddities from the files of longtime Northwest Mushroom Association science aficionados Richard Morrison, Buck McAdoo, and Fred Rhoades.*

Photos by Richard Morrison

Richard found this odd looking yellowish-pumpkin colored fruiting body in the upper left photo on a ditch bank in the mountains of northern California. He was fooled into thinking it was something unusual, even special, until microscopic exam revealed it to be a bizarre form of the common mountain puffball *Calbovista subsculpta* (photo upper right). This species is identified by the unique staghorn shaped hyphae in the spore bearing interior plus small round basidiospores (photo lower left). The sterile base and outer covering of the oddball was composed of yellow-pumpkin colored hyphae (photo lower right) giving it the abnormal coloration. This species is found in the Pacific Northwest, Idaho, California, and Colorado. Fruiting in spring, summer and fall, it is a good edible. In its normal guise the species is almost unmistakable, except possibly for another puffball, *Calvatia sculpta*, which typically has enormous pyramidal warts. No matter, as both are equally edible.



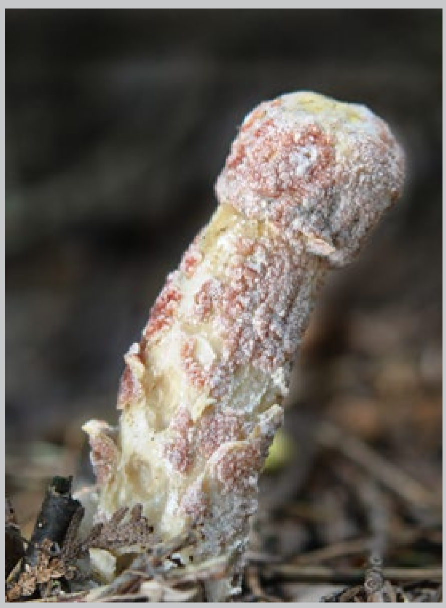
Photos by Richard Morrison

*Continued next page through page 6*

Photos by Richard Morrison

*Morchella snyderi*, Snyder's Morel, is a common woodland morel in mountainous regions of the Western US and British Columbia. It fruits in spring under conifers, sometimes mixed with hardwoods. Richard found the oddball fruiting body with an exploded cap in the photo at far left. It looked like the gaping mouth of a dragon head, and he couldn't pass up taking photos of the anomaly, giving it the nickname "dragon morel." Undaunted by the strange looking form Richard harvested it, tossing it in the mushroom basket along with its abundant, normal counterparts (right photo).

The ascomycete *Hypomyces hyalinus* is commonly called the Amanita Eater, also Amanita Mold. It parasitizes species of *Amanita*, creating strange forms that can stimulate the imagination, like the one in the leftmost photo. *H. hyalinus* occurs across much of North America, as well as parts of Asia. To give an idea of the degree of distortion the Amanita Eater can produce, a normal looking *Amanita pantherina* mushroom is shown in the photo at right.



Photos by Richard Morrison

Photos by Richard Morrison

The Pear Shaped Puffball, *Lycoperdon pyriforme*, is a common, small puffball in the Pacific Northwest that fruits on decaying wood. It is edible when the interior is pure white, not when it turns watery and greenish with maturing spores as in the photo on the right. Sometimes developing fruiting bodies will fuse, resulting in odd forms such as the mature twinned puffball in the right photo, with its long horizontral tear freeing the powdery spore masses for release. Some of its mates have the more typical, central pore for spore release.

*Psilocybe semilanceata*, the Liberty Cap, is a popular psychedelic mushroom found in grassy areas like pastures and open fields. Several years ago Buck came across the twin headed oddball in the photo on the left. Two times the pleasure, two times the fun?

A typical group of prime-for-picking Liberty Cap mushrooms are shown in the photo to the right. Photos by Buck McAdoo

A number of years ago while checking out the Stimpson Family Nature Reserve, Fred ran into this odd twin headed fruiting of *Chrysomphalina aurantiaca* growing on the end of an old Doug fir log. Just goes to show that the genes that control the development in mushrooms don't always work as "planned." In this case, perhaps two heads are better than one for it provides two caps full of gills and spores for one stipe. However, if you look closely, in the photo below you will see that the stipe is twice normal size at its point of origin. So rather than a branched stipe, this is probably an example of a fused stipe.

Photo by Fred Rhoades

Photos by Buck McAdoo

Buck found the strange specimen of *Hygrophorus camarophyllus* in the photo above at Sulphur Creek near Mount Baker, Washington, back in 1986. This fruiting body apparently decided to try a new approach to spore dispersal by producing an inverted cap sans stem on top of a normal cap. Seemingly, this was not much of an evolutionary success as the form has not been observed in this species by Buck since. Normal *H. camarophyllus* mushrooms are shown in the lower photo.

Those of us who teach mushroom identification make a comment early in our discussions about the potentially fatal mistake one could make in confusing an *Amanita* button with an edible puffball. Several years ago Fred found this example near Peace Health hospital in Bellingham. The best example he has seen of this mimicry. The series shows the initial "puffball" stage of an *Amanita* as seen from above, next from the side, and then split in half to show its true nature. Though *Amanita muscaria* is not fatally toxic, it produces a type of poisoning that most people would want to avoid.

One can see in the third photo below in the cut-open button that there is differentiated tissue just below the gray immature gills—the partial veil that will turn into the ring—and an overall coating of yellow-white, the universal veil that will turn into white scales on the cap and volval rings at the stipe base, giving rise to the mature mushroom of this iconic species in the photo on the right.

All photos by Fred Rhoades

Photo by Fred Rhoades

Fred found the Christmas Morel (voilà, *Morchella noélensis*) in 1999 in a location which is now in the Stimpson Family Nature Preserve. That year it occurred quite late, in April, although similar fruitings have been seen elsewhere as early as December. Also known as the smooth morel, this species lacks the usual pitted fertile surface seen in other *Morchella* species. The stipe has an unusual, spirally banded surface and often stains bluish green, particularly after getting wet. Note that there is some dispute among morel experts as to whether it really belongs in the genus *Morchella*, or, as a singularly unique species, deserves the creation of a new monotypic genus of morel-like mushrooms. The name *Pseudomorchella deceptiformi*s has been proposed.

# Spring kings and more Jack Waytz

*Verpa bohemica* in situ, in middle-aged cottonwood bottoms.

*Morchella snyderi*, one of the natural black morels found on the Cascades' eastern slopes.

The 2020 spring mushroom season was a bright spot in an otherwise trying year. After a wet and seasonably warm first week of April here on the west side of the Cascades, a robust wave of *Verpa bohemica* swept through the area's mature cottonwood bottoms. This is an underrated mushroom for the table, with a distinct, if subtle, flavor, and a nice texture when well sauteed.

After April 8, suddenly and uncharacteristically, the weather pattern changed, and a high pressure ridge sealed off northwest Washington from any precipitation for the next three weeks. Worries about a dry season were quickly allayed. The pattern broke at the end of April, leading up to a very wet May and record rainfall in June. West of the Cascades we saw not only an abundance of oyster mushrooms (*Pleurotus pulmonarius*), but two distinct fruitings of them, about four weeks apart. Unusual! In the first wave, I harvested 15 pounds from a single alder snag near a beaver pond, with pounds more left behind!

While enjoying the great flush of oysters, a most unusual season was heading up on the east side of the Cascade crest. Normally, the eastern slope snowpack experiences a late spring thawing and has melted out completely up to about 5000 feet by mid-May. A good mix of warming temperatures and spring rains then elevate soil temperatures to a point where the first natural morels begin to fruit, followed by large, showy clusters of white coral mushrooms (*Ramaria rasilaspora*) and fruitings of legendary spring kings (*Boletus rex-veris*).

*Pleurotus pulmonarius*, the PNW oyster mushoom, on an alder snag. Shelves featured fruiting bodies 8–10" across.

This year, however, was anything but normal. There were cold temperatures and heavy snows in late April and early May pushing the time table back three weeks. Instead of a marked increase in temperatures and decreasing precipitation, conditions on the eastern slopes remained much as they were on the western slopes, cool and rainy, throughout May and into June. Sunny, mild weather and wetter than normal conditions allowed for one of the most prolific, prolonged fruitings of natural morels that I've seen in nineteen seasons of living in the Pacific Northwest. This was very timely for morel hunters, because there were no burns of any real significance in the eastern forests last year and consequently no burn morels to speak of.

The same conditions which so favored the natural forest and alpine morels slowed the fruiting of the spring kings, which traditionally react strongly to the contrast in cool soils and hot air temperatures. And although the spring kings were late, they most certainly arrived with a vengeance, along with the voracious mosquitoes of the eastern Washington alpine forests. Mushrooms are continuing to be found in the final week of June, and will likely run into at least the first week of July, weeks later than in standard years.

*Verpa bohemica* in a champagne cream sauce over jasmine rice, with seasoned, sauteed boneless chicken breast and roasted asparagus.

A 3 1/4 pound fruiting body of *Boletus rex-veris*, the delicious and versatile spring king.

Pristine, snow white flesh of the spring king, being prepared to go into an astonishing Bavarian style cream of porcini mushroom soup.

# Mushroom of the Month
## *Steccherinum bourdotii* Saliba & A. David

Buck McAdoo and Richard Morrison

This is the story of how NMA members Buck McAdoo and Richard Morrison independently happened upon the unexpected find of the toothed wood decay fungus *Stecherrinum bourdotii* in our region within a few months of each other, yet, didn't learn of the other's discovery until several months later. Buck's find came first. The following is his account, including a description of *S. bourdotii*.

It was August 9th, 2019, and I had just finished shopping for marine hardware in Anacortes. There was some time to kill, so instead of heading back to Bellingham directly, I decided on a whim to take the local ferry over to Guemes Island. A rain a few days before had broken a long dry spell, so I figured I might find something on a moss covered log. An islander informed me that the only public area was Guemes Mountain. A Swiss immigrant had sold it or maybe even gifted it to the San Juan Trust. He then mentioned it might be a matter of luck if I found it. There was no sign on the road indicating the trailhead.

I took a right turn off the ferry landing and followed a country road in a northeasterly direction until I spotted three cars parked on the roadside. No home there, just woods. About twenty feet into the woods there was the usual park sign with all the precautions listed. I had arrived at the trail head for Guemes Mountain. The ground was still moist, and sure enough, colonies of mushrooms began showing up on both sides of the trail. They were all *Gymnopus peronatus*, which is temporarily in the genus *Marasmiellu*s until a learned mycologist, who wishes to remain anonymous, gets around to correcting this. And, each time I bent down to look at one, a passerby would ask if it was edible.

Fig. 1 (above). *Steccherinum bourdotii*. Under moist conditions the fibrillose, zoned caps are brown with whitish margins and the young fertile spore bearing spines are often pale colored. Photo by Richard Morrison

The summit was composed of a grassy sward among sunken boulders. No fungi here, but lots of fresh raccoon dung. After admiring the view of islands to the northeast, I headed back down. About halfway down I spotted what looked like last year's *Trametes* on an alder log. The grayish caps were shelving off the log in overlapping brackets. They were slightly hairy, but with zonate darker olive gray lines. I reached down and picked one off the log, turned it over, and jumped as if I'd been bitten. Instead of the tiny rounded pores of *Trametes*, the hymenial surface was composed of orange spines! A semi-blurry photograph soon followed. (Fig. 2).

Back in Bellingham the search for a genus began. I considered both *Irpex* and *Gloiodon*, but neither harbored a taxon with orange spines. Then, a key to genus in *Nordic Macromycetes*, Vol. 3 finally led me to *Steccherinum*. I discovered that the most commonly found *Steccherinum*, S. ochraceum, can have pale orange spines when young. I found a description for *S. ochraceum* in the latest *Collins Fungi Guide*. On the same page was a description for one *S. bourdotii*. This could have pinkish-salmon spines when young. The main difference was in the shape of the spores; elliptic for *S. ochraceum* and subglobose for *S. bourdotii*. The collection from Guemes Mountain had subglobose spores measuring 4–5 x 3.5–4 microns. Bingo. Could this be the first record of this fungus for western North America? The *Collins Fungi Guide* mentioned it was widespread in Europe but seldom collected. Few sources cover *S. bourdotii* even in Europe, where it fruits on rotting hardwoods, mainly hornbeam, several oaks, and alder. In India it was reported on Himalayan cypress.

*Steccherinum bourdotii* was first described from France in 1988. *Irpex bourdotii* is a synonym. According to

Fig. 2. *Steccherinum bourdotii*. Buck's Guemes Island find. Under dry conditions the zoned caps turn grayish to white. Photo by Buck McAdoo.

Fig. 3. *Steccherinum bourdotii*, close up of the spore bearing spines as they develop pinkish coloration. Photo by Richard Morrison.

Spanish mycologists Annarosa Bernicchia and Sergio Perez Gorjon, it has shown up in Spain, Estonia, Italy, Germany, England, the Ukraine, Turkey, Poland, Finland, Russia, and Macedonia. In 2016 Sanyal, Devi, and Dhingra reported it from Uttarakhand state in India. The mycological collections website MycoPortal lists five collections from the eastern United States, but none from the western United States or Pacific Northwest (PNW).

Fruiting bodies are described as resupinate to effused-reflexed, some eventually extending about a centimeter off the log or other woody substrate. The caps are pubescent to fibrillose and cream color to grayish-brown, usually with a paler band at the margin. The Collins Fungi Guide thought they were probably biennial. They described the context as tough, leathery, and pink. The spines, according to Gerrit Keizer, are creamy buff at first, and he has the photo to prove it. They must then go through the salmon-pinkish stage before aging to a salmon color or when they dry. He described the spines as 2–3 mm long. The spore deposit is white, the spores inamyloid, smooth, and subglobose. According to Henrici, they are also guttulate and acyanophilous.

Microscopically, the hyphal system is dimitic, being comprised of both generative and skeletal hyphae. The generative hyphae are 3 microns wide, often branched, and with clamps. The skeletal hyphae are thick-walled and run up to 4.4 microns wide. The basidia are 4-spored, clavate, and clamped at the bases. There are also cylindrical to clavate pseudocystidia that are thick-walled with heavily encrusted, obtuse apices. The Indian authors refer to these as "skeletocystidia." They also remarked on basal cystidia parallel to the substrate and loosely interwoven.

**Five months after Buck made his collection** on Guemes Mountain, Richard happened upon *S. bourdotii* at two locations near his home in Sudden Valley outside of Bellingham. The following is Richard's account:

My first collection (Fig. 1) was found on a dead alder sapling in late January 2020 while I was scouting along a trail looking for fleshy fungi to photograph. Spotting what looked like a classic group of the Turkey Tail polypore, *Trametes versicolor*, I was surprised when the fertile undersurface was not a layer of minute pores as expected, but possessed an array of spines and tooth-like projections! My first thought was, it's an *Irpex*, and I need a decent photo of a species in this genus. I took the short walk home, got a saw, cut off the lower section of the sapling with the mushrooms attached and took it home to get photos under better lighting and to study the specimens.

Identification began using James Ginn's *Polypores of British Columbia*. Only one species of *Irpex*, *I. lacteus*, was included, but neither the gross morphology nor microscopic features fit the alder sapling fungus. In looking into other toothed polypore relatives on the internet I came across the genus *Steccherinu*m, then pulled up a 2016 paper from India by Sanyal et al. which had a good key with full descriptions of ten species of *Steccherinum*. The collection keyed out to *S. bourdoti*i in fruiting body form, spore shape, size, and the richly encrusted skeletocystidia. There were also good photos of *S. bourdotii* on the internet that matched the dead alder collection nicely. Since *S. bourdotii* has not been reported from the PNW, I thought I had something special. Feeling very pleased with my discovery, I called Buck to announce it. But, my thoughts of having made the first find of this species in our region were brought back to reality when Buck told me he had found it on Guemes Island the past August. I should have figured as much, knowing that Buck is the master of mushroom discovery in our mushroom club, and likely the PNW.

While walking along a road in early February 2020 I found a second cluster of *S. bourdotii* fruiting on a chunk of dead alder wood which it cohabited with the Turkey Tail. I carted this home, and placed it outdoors with the alder sapling collection and observed them over the next couple of months. Spines of the two collections were creamy to light peach colored at first, as described by Keizer, but not as orange or reddish as described in some other literature. During wet spells and warming temperatures the creamy colored pines changed to peach or light salmon (Fig. 3). When dried, spines turned a slightly darker salmon color. Some areas of the fruiting bodies were discolored a rich brown (Fig. 4). If fruiting bodies are biennial, they are likely marcescent, i. e., after drying out, they can revive with wet conditions and produce a new crop of spores. To test this out I removed several dried, whitish fruit bodies from the alder log and placed them on wet towels in a closed container at room conditions. Within two days the caps softened and expanded, the cap surface returned to a rich dark brown and the spines became salmon-pink. After a couple more days a few rehydrated caps were placed spines down on a glass slide in a moist container to determine if spores were being shed. The following day white spore prints were evident under the caps. Microscopic examination revealed them to be fresh masses of the subglobose spores characteristic of *S. bourdotii*, clear evidence the species is marcescent.

Studies have shown that *S. bourdotii* is a secondary white rot decomposer of wood, colonizing woody substrates following the initial invasion and degradation by a primary white rot fungus such as *Trametes*. *S. bourdotii* has been found to produce laccase enzymes that are more efficient, have different substrate specificities and can further degrade and utilize wood decay components following a primary decay fungus. This is a type of metabiosis, where the activities of one organism create a favorable environment for another. This would explain how *S. bourdotii* could amiably cohabit the alder log with the Turkey Tail as a member of the microbial succession in wood decomposition.

At about the same time as Richard's winter collections, Buck received an email from Daniel Winkler with a photo he had taken of a wood decay polypore with salmon colored spines—very likely another *S. bourdotii* in the PNW. Seemingly, from out of the blue, this taxon is showing up in Washington State and the PNW. Yet, maybe it has been here all along. Supporting this is a DNA sequence in GenBank from British Columbia in 2010 identified only as *Steccherinum sp.* that is 99.7% similar to *S. bourdotii*. As this article is going to press, the identity of our *S. bourdotii* from Washington State was confirmed by DNA sequencing. So, it seems likely that this species has been overlooked due to its resemblance to the more common thin fleshed shelving wood rotters like species of *Trametes* and *Stereum*.

Fig. 4. Effused-reflexed and resupinate fruiting body forms of *Steccherinum bourdotii*. The white fungus at lower right is *Trametes versicolor*, the Turkey Tail. The two species are sharing the alder log. Photo by Richard Morrison.

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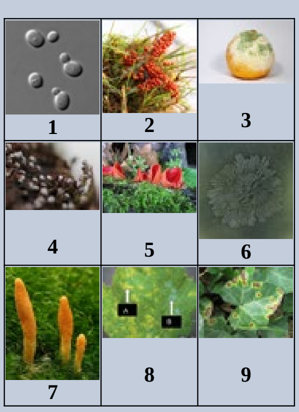


**Answers to "Is It A Fungus?"** (page 3)

1. Fungus: Brewers yeast, *Saccharomyces cerevisiae*
2. Not fungus: Plasmodial slime mold
3. Fungus: unidentified mold
4. Not fungus: Plasmodial slime mold
5. Fungus: Scarlet Cup, *Sarcoscypha coccinea*
6. Not fungus: crystal deposit of unknown composition
7. Fungus: *Cordyceps militaris*
8. A: Not fungus: downy mildew, Oomycota. B: Fungus, powdery mildew, order Erysiphales
9. Not fungus: Bacterial leaf spot, *Xanthomonas*

# *Sporidesmium folliculatum*, a black mold on wood

Richard Morrison

On walks through the woods do you ever notice the black patches and streaks on exposed, rotting wood and wonder what they are? They are likely the sexual state of an ascomycete, or the colonies of a dematiaceous mold, the asexual state of a blackish pigmented microfungus which reproduces by spores called conidia. The dematiaceous molds are placed in a diverse group of fungi named the Fungi Imperfecti, "imperfect" because they have no sexual state. Some dematiaceous molds also have an ascomycete sexual state, the teleomorph, which produces ascospores in flask shaped perithecia. Not all anamorphic dematiaceous mold species are known to have a teleomorph, and conversely, not all teleomorphic species have a known anamorph (for more on anamorphs and teleomorphs, see Fred Rhoades article on holomorphs, next page).

I came across the dematiaceous mold (Fig. 1) written about here while exploring an area just off the main trail in the Stimpson Family Nature Reserve. Taken by the symmetry of the elliptical black patches that contrasted with the lighter colored exposed wood along the trunk of a downed red alder, I took photos and samples to examine. What I saw under the microscope were handsome, multiseptate dark conidia and dark blackish conidiophores (Fig. 2). I needed help in the identification, and turned to Buck McAdoo and his extensive library on fungi. I found the answer in a book *More Dematiaceous Hyphomycetes* by the renowned authority on dark pigmented anamorphs, Dr. M. B. Ellis, with a match to *Sporidesmium folliculatum*. This species is found on decaying hardwoods in many parts of the world. *Sporidesmium* is a polyphyletic genus, with species having evolved from several different ancestral lineages. Thus, the taxonomy of *Sporidesmium* is complex and mycologists continue to study the group. Teleomorphs of *Sporidesmium* species are rarely known, but some are found in the ascomycete class Dothideomycetes which produce sexual spores in perithecia embedded in a black stroma like those in Fig. 3. To date the teleomorph of *S. folliculatum* has not been discovered.

Uncovering the pairing of an asexual anamorph with its sexual teleomorph will take the comparison of their genetic signatures by professional fungal taxonomists. For most of us, though, it is satisfying enough to be able to recognize asexual black colored molds and black crust-like stromatic ascomycetes on decaying wood, and appreciate their role in the ecology of forest and woodlands.

Fig. 1. Black, elliptical, slightly sunken colonies of *Sporidesmium folliculatum* on the wood of a fallen red alder log in Stimpson Family Reserve. Can you find the black slug and the fruiting body of a *Stereum* in the photo?

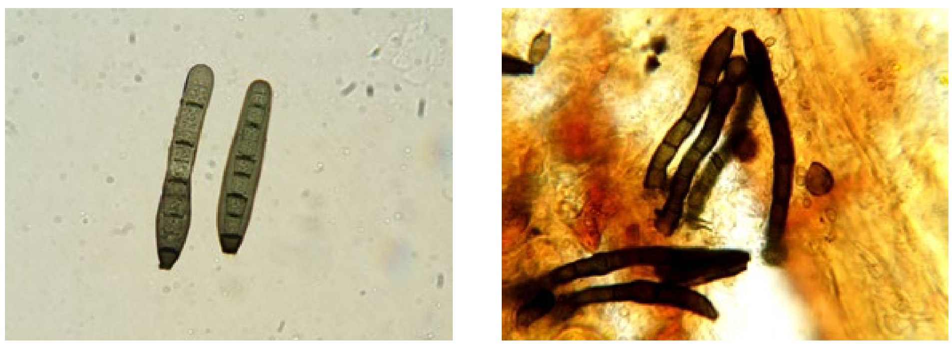

Fig. 2. *Sporidesmium folliculatum* asexual fruiting structures: dark grayish-black conidia (left) are produced from the blunt tips dark of colored conidiophores (right) which arise from mycelium in wood. Conidia are spread by wind and rain, germinating to produce new mycelium to colonize dead woody substrates.

Fig. 3. Black, elliptical raised sexual fruiting structures of an unidentified ascomycete fungus on decaying red alder wood (top). A close-up (bottom) shows the many small protruding openings of the ascospore-bearing perithecia embedded in the black supporting stroma.

# The holomorph: The secret sex lives of mushrooms

Fred Rhoades

As Dick Morrison's article about *Sporodesmium folliculatum* shows, not every fungus you run across out in the woods is what you first think it might be. Partly to fill in some details about this that Dick doesn't want to bog down his article with and partly to introduce you to an incredible mycological resourse, I present this article. Along the way it will explain what is meant, mycologically, by the equation, Holomorph = Anamorph + Teleomorph.

As the study of fungi developed as a discipline in the 1800s mycologists became aware that these spore-producing, non-photosynthetic "plants" produced a great variety of small "seeds." We now call these small seeds spores. They are either one-celled or composed of just a few pretty much identical cells, unlike seeds which contain hundreds of cells arranged into tissues, including an embryonic plant. There are a great many kinds of spores differing in shape, color, number of cells and the precise way they are produce from the mycelium (the diffuse fungal body) or from fruiting bodies growing from the mycelium. Mycology students groan when they have to learn all their names.

Early mycologists categorized this diversity of spores to make some sense of it all. One basic difference was observed that divides the spores into two groups: spores involved in sexual change (they ultimately grow into genetically different individuals than the parent) and asexual spores (spores that grow into clones of the parent). Of sexual spore production we recognize two types in the macrofungi (mushrooms, morels, and their relatives): spores produced on club-shaped basidia in the phylum Basidiomycota and spores produced in tubular asci in the phylum Ascomycota. Ultimately, if you want to determine if an unknown fungus is in one of these phyla, you need to find either basidia or asci somewhere in the fructification. Asexual spore production can be by a great many mechanisms that have, themselves, been categorized over the last century. The system finally developed in use today is quite complex and we don't need to get into the details here.

Back to the history. The Tulasne (pronounced "Two-lane") brothers lived rather hermitical lives in southern France, studying and illustrating nature, particularly fungi, and presenting their observations in over 50 publications. Louis-René Tulasne was a skilled microscopist and careful observer of all he looked at while Charles Tulasne, though a physician and also a skilled observer of nature, was especially skilled in lithography, the artistic technique of producing finely printed images using polished and treated stones.

In a series of volumes (see citation at the end), the Tulasnes proposed for the first time that there was a connection between sexual and asexual states of many Ascomycota. They documented this proposal with textual descriptions and beautiful lithographs of the various forms the fungi take. We now know this connection to be true in both the Ascomycota and the Basidiomycota. Using modern terminology, a given fungus can exist in several forms: an "anamorph" that produces asexual spores and a "teleomorph" that produces sexual spores. By international agreement, it is the teleomorph by which a fungus is ultimately categorized taxonomically.

The strange thing is that some fungi have dispensed with sex and only produce asexual spores from an anamorph. Dick's *Sporodesmium folliculatum* is one of these for which the teleomorph has not yet been found. A great many other "molds" such as some species of *Penicillium* and *Aspergillus* are thought to not ever reproduce sexually (they do have a way to change genes that is called parasexuality, but that is another story). The complex subject of the development and use of a separate naming and identification system for anamorphs will not be dealt with further here or this article would be twice as long.

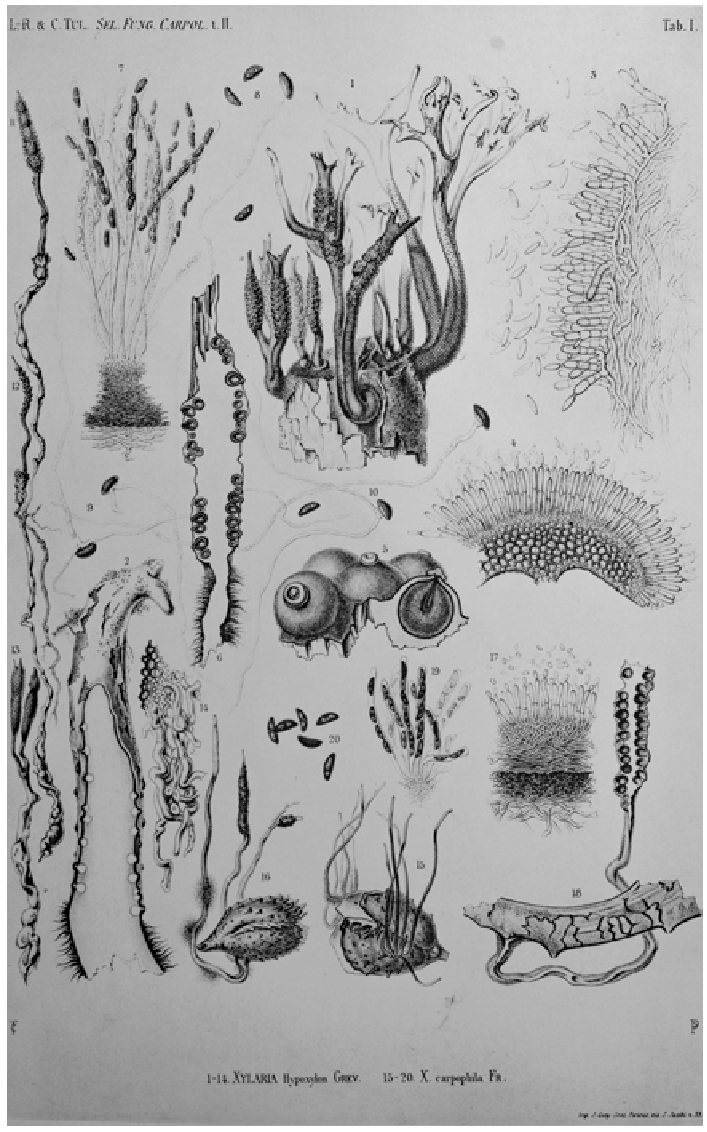


Fig. 1. Tulasne Vol II Plate I *Xylaria.*

Fig. 2. *Xylaria hypoxylon.* Anamorph to left, teleomorph to right. Photo by Fred Rhoades.

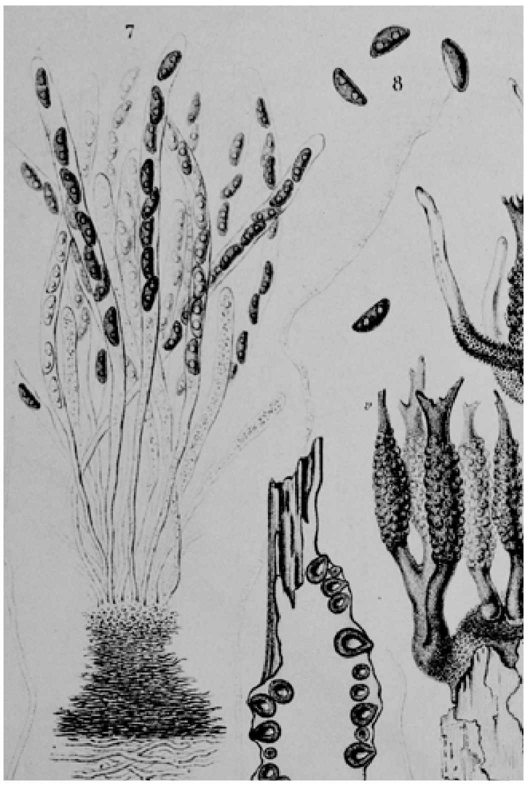

Fig. 3. Part of Plate I showing teleomorph of *Xylaria hypoxylon*.

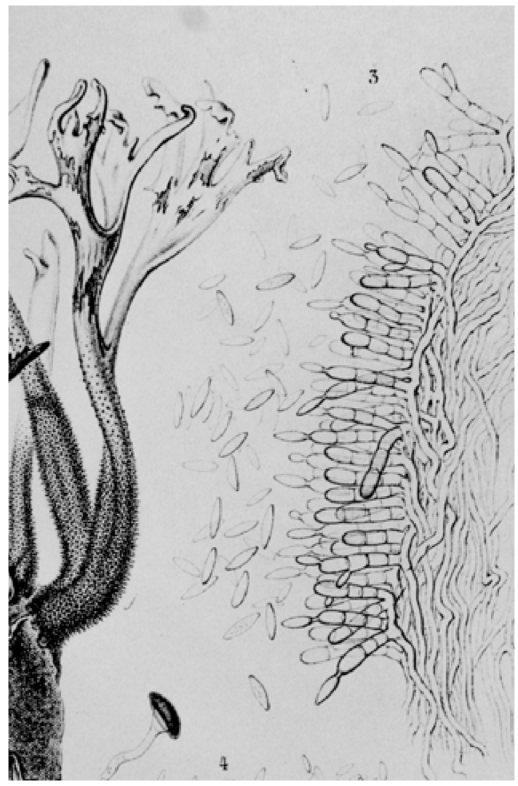

Fig. 4. Part of Plate I showing anamorph of *Xylaria hypoxylon*.

In the last three decades particularly, a great many fungal "holomorphs" (! = anamorph + teleomorph) have been documented. And now with molecular information, an observed, physical anamorph-teleomorph tie-in is not needed since a look at genes will tell mycologists what group of Ascomycota or Basidiomycota a given anamorph is in (see Dick's discussion of *Sporidesmium*, page 11).

How does this work? I'll use a common example, *Xylaria hypoxylon* ("candlesnuff fungus") that most people have seen locally to describe this (see my photo of the holomorph in Fig. 2). It is illustrated in the Volume 1, Plate I of Tulasne's magnum opus that I use here (Fig. 1, and two close-ups in Figs. 3 & 4). I encourage you to look in the online version cited below to peruse this and other plates more closely.

In many Ascomycota, the fungal mycelium first forms spores asexually. In *Xylaria hypoxylo*n, which inhabits decaying wood, this takes the form of a white powder on antler-like branches (left of Fig. 2 and in detail in Fig.4). These spores are single celled and rapidly produced in succession from the ends of special cells within these branches—see the rightside close-up of Figure 4. This is adaptive because it provides a way to rapidly reproduce genetic copies that can grow and inhabit an area that already has provided good growing conditions for the species. Later, the same fungus produces the teleomorph, a different kind of branch that produces asci and brown, kidney-bean–shaped spores within (Fig. 3, asci to the left). The spores produced in asci are genetically different than the parent and, potentially, may be adaptive to different environmental conditions they may find themselves in the following year.

You may wonder about mushrooms in the Basidiomycota. The mushrooms are the teleomorphs. What do their anamorphs look like? For a great many mushrooms where anamorphs have been found, particularly growing in cultures grown from mushroom spores, the anamorphs are produced in tiny gooey globs on the mycelium. In one mushroom, *Dendrocollybia racemosa*, the anamorph is physically tied to the teleomorph on the ends of side branches off the stipe. Very unusual and very strange (Fig. 5).

Here is the full publishing information for the opus. The plates discussed in the text are at the ends of each of the three volumes.

Tulasne, L. R. and C. Tulasne. 1861–1865. *Selecta Fungorum Carpologia. Exhibiting especially those facts and illustrations which go to prove that various kinds of fruits and seeds are produced, either simultaneously or in succession, by the same fungus.* 1931 English translation by W. B. Grove, edited by A. H. R. Buller. Oxford University Press. Latin version downloadable from Missouri Botanical Garden: https://www.biodiversitylibrary.org/bibliography/50436#/summary

Fig. 5. *Dendrocollybia racemosa*. Asexual spores at the ends of the side branches; sexual spores from basidia on gills. Photo by Fred Rhoades.

# It's the small stuff, photo gallery Richard Morrison

Fruiting bodies of the slime mold *Ceratiomyxa fruticulosa var. poroides* (below, right) and the Eyelash Pixie Cup fungus, *Scutellinia scutellata* (left) share space on a wet, rotting red alder log in Stimpson Family Reserve near Bellingham, June 2020. The genus name *Ceratiomyxa* means "waxy mucous," and when wet the little white honeycombed fruiting bodies do turn into gelatinous blobs of mucous. The small, red to orange-red Eyelash Pixie Cup fruiting bodies are fringed with black setae, giving this little cup fungus its common name. The cups in this photo are about 5 mm across, but can be as wide as 15 mm. Even though colorful, the cups can be overlooked on a water-saturated, moss-covered rotting log. These two species belong to totally unrelated groups of organisms, yet both make a living as saprobes feeding on well-decayed wood and woody debris.

Eyelash Pixie Cup with the white slime mold, *Ceratiomyxa fruticulosa*. Photo by Richard Morrison


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Northwest Mushroomers Association promotes the understanding and appreciation of mushrooms: furthering the study of fungi, their identification, natural history, ecology, and conservation. We serve mushroom enthusiasts in northwest Washington State, including Whatcom, Skagit, and Island Counties.

To comply with physical distancing during the Covid-19 outbreak, NMA has put its membership meetings and talks on hold for the time being. Our Board will reevaluate on a monthly basis when to resume meetings and forays. To stay apprised of forays, events, meetings, and more, join our googlegroups email list as a club member. Or visit northwestmushroomers.org/events or facebook.com/NorthwestMushroomersAssociation.

MushRumors is published at northwestmushroomers.org. Club members are encouraged to submit stories, photos, recipes, and artwork. We appreciate your interest! Send your articles and art to editor Erin Moore, chanterellerin (a) gmail.com.

*Chlorophyllum olivieri*, fruiting on July 2, 2020, in Whatcom County. Shaggy parasol is a species known most often to fruit in fall. Photo by Brandon Sigurdson.

**You Know My Name**

On foray day, search for me
with bulging eyes, stomping feet
On soggy log, from rotten leaf
Shout with glee: mushroom found!
But that's not me, just my seed

Books and keys list words so well
Practiced memory learns say and spell
Down below I dwell

By light and probe, try, you never will find me
Smell, not see
Phantom of chemistry
Micron threads suffuse a world below
A microbe creature, I feed you
In the end I eat you

Mushrom play
Invisible realm of hyphae
At least
You know my name

—Eric Worden