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THE ADVENTURES OF A MYCODETECTIVE: GARY LINCOFF REVEALS THE PUZZLE

by Rena Wertzer (and Gary Lincoff)

On Sunday, June 25th, father's day, Taro Ietaka led a joint walk of COMA and Central Westchester Audubon Society (CWAS) at Saxon Woods Park. It would have been the ideal walk for me, since I have been active and on the board of both groups, and Saxon Woods Park is almost a walk from my house.

Alas, I had other obligations and could not go, but I was interested in finding out what people had collected. I have always found Saxon Woods to be rather barren of fungi. On Coma's Facebook Page a few days latter , I saw Boris Martinov's photo of a very unusual looking polypore that had been found on the walk. It had been labeled *Hydnopolyporus fimbriatus* which, I learned latter, was the result Damon Brunette's search on Mushroom Observer.

Hydnopolyporus fimbriatus (Cooke) D.A. Reid, 1962 Photo by Borislav Martinov

It was so unusual looking to me - like nothing I had ever seen, and I was curious to learn something more about it than its name. I looked it up online and found nothing. That was also unusual. The only thing I found close to it were two references to *Hydnopolyporus palmatus* in *Mushrooms Demystified* by David Arora. One reference was in a key to *Polyporous*, *Albatrellus*, & Allies and the other reference was in a key to Stereaceae & Allies. Arora states this is found in the tropics and along the Gulf Coast. (Continued on p. 3)

FORAYS & OTHER EVENTS

This section of ***The Mycophile*** is reserved for publicizing the annual forays of NAMA affiliated clubs and other events you may be interested in learning about. If you would like us to list your club's next big event, contact us with details you would like displayed here and send to the editor dianna.smith@comcast.net.
See also http:/namyco.org/events/index.html.

September 4-7: COMA's annual **Clark Rogerson Foray** will be held at Berkshire Hills Emmanuel Camp in Copake, NY and is easily accessible from NYC, the Hudson Valley, Connecticut and Massachusetts. See www.comafungi.org/special-events for information on registration.

September 11-14: **Wildacres Foray** in North Carolina. (See page 23 in ***The Mycophile*** for further information).

September 13: The Fourteenth Annual Gary Lincoff Mid-Atlantic Mushroom Foray (See http://wpamushroomclub.org/lincoff-foray/).

October 4-5: The Ohio Mushroom Society is sponsoring a fall foray in the Hocking Hills region of southern Ohio. Home base will be the Gibsonville Community Center on Rt. 678, just off of and south of Rt. 33. This is about 15 minutes from Logan, Ohio. For further information contact Shirley McClelland at shirleymcclelland@msn.com.

Cortinarius alboviolaceus in late fall, White Mts. of NH

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When I saw Gary at COMA's Fungus Fair Lite, I asked him to look at Boris's photo on Facebook and see what he thought about this odd polypore. He agreed that it was very unusual looking and said he would look into it and get back to me. Below is Gary's email to me : a tale of detective work and a puzzle yet to be solved.

Hydnopolyporus fimbriatus……..Damon Brunette posted Boris Martinov's photo on Mushroom Observer: June 22, 2014, Mamaroneck, NY.

Found on a COMA foray this past spring, and posted on the COMA Facebook page, *Hydnopolyporus fimbriatus* is more like a duck-billed platypus than a mushroom you might recognize. The platypus, as you know, looks like one of those toy animals you put together with pieces from other animals. Yet the platypus is real, and so is *Hydnopolyporus fimbriatus,* whatever it is.

Checking Index Fungorum, always a good place to start, I discovered it has been placed over the years in a dozen different genera, and that there are at least 2 recognized species, *Hydnopolyporus fimbriatus* and *Hydnopolyporus palmatus*. Elias Fries published what we now call *Hydnopolyporus fimbriatus* as *Polyporus fimbriatus* in 1830, and as *Thelephora craspedia* in 1851.

Although I have never seen this mushroom before, at least knowingly, I remembered seeing a photo of it, or its name, in one of the field guides I have. Looking through my stash of guides, I found Nancy Weber and Alex Smith's *A Field Guide to Southern Mushrooms*, and it has *Hydnopolyporus palmatus* described and illustrated in it. It's not the same species as *H. fimbriatus*, and its distribution is given as southern, that is, the West Indies and South America. Next I checked R.W.G. Dennis's *Fungus Flora of Venezuela*, and it included a description of *H. palmatus*, and referred to Overholts' *Polyporaceae*. Indeed, it's there as *Polyporus fimbriatus*, and Overholts notes specimens examined from Alabama and Louisiana.

As Fries described it as a *Thelephora*, I checked Burt's *Thelephoraceae of North America*, and there I found it described as *Stereum craspedium* (Fries) Burt, n. comb. Burt thought it resembled *Tremellodendron pallidum*, and reported it from Mexico and South America.

To muddy the waters a bit more, Index Fungorum lists *Hydnopolyporus* in the family Meripilaceae, that is, in the same family as the Black-staining Polypore, *Meripilus sumstinei* (*M. giganteus*).

Will wonders never cease!

What it's doing in Westchester is anyone's guess, but it is certainly one of the spectacular finds of the year. And thanks go to Boris Martinov for the photo and to Damon Brunette for identifying this most curious mushroom.

So what have learned? If you find a mushroom that looks like a duck-billed platypus, it probably is. This one can be hydnoid (with teeth), poroid (with pores), or looking somewhat like a *Stereum* or a *Thelephora* or even a *Tremellodendron*. If you're a beginner, maybe sometimes it's just better to look the other way. And, as for the question, whether or not it's edible, well, do you want to be the first one to eat a mushroom of unproven edibility?

Hydnopolyporus fimbriatus photo by Borislav Martinov

Fuligo septica Photos by William Needham

Fuligo Septica

by William Needham
MAW Secretary

(This article was first published in the spring 2014 edition of *The Potomoc SPOROPHORE*, Vol. 29 No. 2 Newsletter of the Mycological Society of Washington, D.C. under the title "Sooty Witch Troll Cat Slime.")

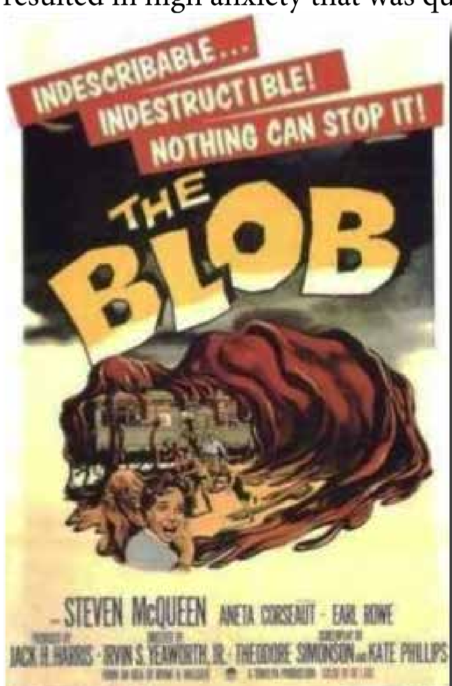
Common Name: Scrambled Egg Slime, Dog Vomit Slime
Slime is any soft, gelatinous and formless mass - a descriptive term that has no biological specificity. Slime is an abbreviated form for the more descriptive full name slime mold; it is in a sense both slime and mold. The color and texture are metaphors for scrambled eggs if yellow and dog vomit as it turns a tan-brown color with age.

Scientific Name: *Fuligo septica* – The genus name is Latin for 'soot' and the species epithet is derived from septicus, Latin for 'putrid' (as in septic tank). The overall intent is to convey a black, particulate substance associated with the putrescence of bacterial decomposition; *F. septica* starts out yellow and gradually turns black with age - which may be why the genus is named 'soot,' which must surely be black.

Like the centaurs and satyrs of Greek mythology, slime molds are an incongruous combination of two separate and distinct physiologies, a fact that has confounded their proper classification within the hierarchical confines of taxonomy. Even the slime mold name conveys a notion of some sort of unholy union; a dichotomy of uncertain provenance. Slime molds start out as spores from a fruiting body that is fungal in form and function which would align them with the fungi. When the fungi were afforded full kingdom status in the late 20th century, slime molds were placed in the Phylum Myxomycota (Greek for 'mucous fungi' a suitable synonym, essentially biological slime). It is for this reason that the slime molds are included under the rubric of mycology. However, when the fungus-like spores germinate, they do not form the filamentous hyphae of the fungi, but rather they transmogrify to single-cell nucleated amoeboids that move about with pseudopodia just like any other amoeba of the Kingdom Animalia. So slime molds are slime in the sense that they are viscous and mobile and they are mold in the sense that they are small fungi. In the continuous evolution of our understanding of the taxonomy of biological relationships, slime molds and other mostly unicellular, eukaryote (having a nucleus) anomalies gave rise to an interim taxonomy of things that were both plant and animal and therefore neither; they were placed in the Kingdom Protista. Recent advances in biology, genetics and evolutionary development have discombobulated the physical structure based taxonomy of Carolus Linnaeus – a process that is far from over. The slime molds are in the Kingdom Protozoa (Kingdom Amoebozoa in some texts). To afford a measure of consistency, the slime molds retain their euphonious group name, as they are now in the Class (vice Phylum) Myxomycota, even though the kingdom has changed. This doesn't make the slime molds any less peculiar.

The mobile unicellular, amoeboid animalcules afford the slime molds their quixotic life cycle. They are phagotrophic, feeding on the even smaller bacteria for nutrition, the characteristic that aligns them with the Protozoa over the Fungi. The amoeboids can be in one of two forms: a myxamoeba that moves by the extension of the membrane wall (false foot or pseudopod) and an elongated form called a swarm cell with a whip-like flagellum from one end or the other (or both) to enhance propulsion. In the absence of nutrients, the amoeba is transformed into a thick-walled protective sphere called a cyst in which state it can persist for some time. Under nutrient rich propitious conditions, two amoebae or swarm cells of compatible mating types (like the fungi, there are no recognizable male or female sexes) fuse together, the two haploid (n) gamete cells forming a diploid (2n) reproductive zygote. The resulting structure is called a plasmodium, the quintessence of the slime mold. The nucleus is a single large cell that undergoes mitosis (nuclear division) without cell division. That a single cell can multiply geometrically (2,4,8,16) up to millions of nuclei all within a single cell membrane. Plasmodia grow, like their amoeboid precursors, by eating bacteria in addition to yeasts (which are fungi) and algae (some of which are classified as plants, though most are placed elsewhere). In this form they can get quite large, able to engulf and ingest increasingly larger prey. It is the growth of the plasmodia that characterize the slime molds, as the growth is coupled to movement. According to Michael Carlisle et al in *The Fungi*, 2nd Edition, this streaming is observable in a microscope that shows "a torrent of protoplasm moving in one direction at speeds of up to one millimeter per second for about a minute." Curiously, the flow then reverses, like the Greek strophe, flowing in the opposite direction for about the same duration – a pulsating mass. The efficiency of consumption, movement and growth is such that a slime mold can double its original size within 8 hours.

A large, moving, pulsating and growing blob of unknown origins has, on at least one documented occasion, resulted in high anxiety that was quite possibly triggered by association with the 1957 movie "The Blob" in which a formless mass terrorized a small town killing several people. The incident in question occurred in Garland, Texas, a small town near Dallas in the backyard of Mrs. Marie Harris. According to an Associated Press article on 30 May, 1973 "It's something right out of an after-midnight television horror movie – a mysterious, encompassing ooze, dubbed 'The Blob.' - So far it appears to be friendly." The Dallas Times Herald first reported the incident quoting Mrs. Harris as asserting that "it has multiplied itself 16 times over in two weeks...blackish mucous…reddish with thick bub-gigs (sic) on top…foamy like shaving cream." A neighbor named Edna Smith reported that it had climbed a telephone pole. The origins of the tale have become apocryphal in the retelling, a mycological urban legend. According to the *Audubon Field Guide to Mushrooms*, the fire department was called and used high pressure water, which encouraged it to grow even larger, at which point the "people demanded that the governor call in the National Guard." The culprit is identified as a relative of many-headed slime (*Physarum polycephalum*), although this is also subject to conjecture. The International Herald Tribune of 1 June 1973 reported that "Dr. Fanny Hurst, a botanist at Baylor University" determined that "it could have been a Fuligo … usually seen in the yellow, pulsating form Mrs. Harris described to newsmen."



That it is was more likely to have been scrambled egg slime is affirmed by Miller and Everhart in "Importance of Myxomycetes in Biological Research and Teaching" (*Fungi* Vol. 3 No. 1), who noted that "These yellow blobs were present for a three-week period and the fruiting bodies were finally identified as *Fuligo septica* but not after concern that a lawn disease or an alien source had invaded the site." The demise of the dreaded yellow blob was no less mundane. Again from the 1973 Associated Press article: "Mrs. Harris …recounted 'I got a call from a woman here in Dallas who said that tobacco mixed with water was an old-time remedy for killing insects in gardens. I figured I had nothing to lose and tried it. It started to dry up and that's what's left.' She pointed to some white, crusty material at the edge of her garden. So much for the original blob." Like all other slime molds, it probably ran out of food and sporulated.

The study of slime molds has lagged behind that of other organisms, their sub rosa habitat under tree bark and leaf litter seldom rising to the notice of early botanists (or zoologists for that matter), the blob story notwithstanding. The slime molds like *F. septica* that form a plasmodium are appropriately called plasmodial slime molds to distinguish them from the other two types of slime mold amoebozoans: the cellular slime molds (dictyostelids); and the protostelid slime molds (protostelids) - primarily epigeal soil dwellers and, though ubiquitous, are nearly invisible without magnification. The larger plasmodial slime molds do on occasion draw attention (again the blob story). According to Stephenson in *The Kingdom Fungi*, "in writings from the ninth century attributed to the Chinese scholar Twang Ching-Shih, there is a reference to a certain substance kwei hi (literally 'demon droppings') that is of a pale yellowish color and grows in shady damp conditions." While a somewhat more scatological description, this is clearly referring to the subject slime, which is not wanting for metaphor. The leitmotif of offal seems to be as universal as is the global *F. septica*. In Scandinavia, it is associated with the superstition of the witch's troll cat, a chimerical beast that got its milk either directly from cows or stole it from households. The yellow slime mold was attributed to troll cat vomit and purportedly used by witches to spoil the milk of those they cursed. As testimony to the diversity of cultural norms, the Native Americans from Cofre de Perote in Veracruz, Mexico call *F. septica* "caca de luna" meaning 'moon scat' but treat it more like the scrambled eggs of North American linguistics. They harvest it, cook it with onions and peppers and eat the resultant concoction on a tortilla, reportedly with (gustatory) relish.

The plasmodium of a slime mold continues to grow only so long as there is nutrition. If adverse conditions prevail, a dormant state called a sclerotium forms to sustain the germ of life through the downturn. When conditions promoting reproduction prevail, the plasmodium gives rise to fruiting or spore-producing, bodies that resemble (though are generally much smaller than) those of most fungi NAMA members usually collect and study. Plasmodial slime molds are taxonomically classified according to one of four basic types of fruiting body: sporangium, aethalium (basically a mass of fused sporangia), pseudo-aethalium, and plasmodiocarp (a vein from the plasmodium). *Fuligo septica* forms a massive aethalium (the second type), which gives it a prodigious spore production capacity – billons of ~7 micrometer spinulose spores released to the wind. Due to its proximity to human habitations, its ubiquity, and the spiny tenacity of its spores, it has been subject to assessment as an allergen. A study conducted by Rockwell et al and reported in the *Journal of Allergy and Clinical Immunology* found that 40 percent of the 250 participants had an allergic reaction to *F. septica* and concluded that "Individuals hypersensitive to mold spores should use face masks to avoid contact with slime mold spores." A second area of scientific evaluation of the properties of *F. Septica* is in bioremediation – not an uncommon consideration for fungi, which extract minerals from the environment as a matter of physiology. At the International Symposium of Metal Ions in Paris in 2008, a Finnish researcher reported that *Fuligo septica* (commonly called paranvoi in Finnish – this translates roughly to 'belief being,' thought to have something to do with the theft of butter contained between 2,000 and 22,000 mg/kg (which is the same as ppm) of zinc. This was attributed to the fact that the yellow pigment fuligorubin A binds to zinc. The potential of *Fuligo septica* for reclamation of metal-contaminated soils awaits demonstration.

1. 8:00 AM

2. 12:00 PM

24 HOUR TIME-LAPSE PHOTOS of *FULIGO SEPTICA*

Steve Rock of the Connecticut-Westchester Mycological Association (COMA) took four photos of *Fuligo septica* found in his yard on a rotting maple stump. The first photo was taken at 8:00 AM. The second at 12:00 PM. The third was taken eight hours later at 8:00 PM. The last photo was taken at 8:00 AM the following morning. He writes: "It is the breakdown of tissue that creates the dark liquid spots that are most evident in the fourth and final shot."

3. 8:00 PM

4. 8:00 AM

NEW EDITOR FOR *McILVAINEA* by David Rust

I am happy to announce that we have a new editor for McIlvainea.

Willow Nero is editor for the Mycological Association of Washington's quarterly newsletter Potomac Sporophore. She first became interested in mycology in 2011 when she read Michael Pollan's *The Omnivore's Dilemma*, which recommended hopeful foragers join their local mycological associations. After a few forays with MAW, she was hooked and happily exploring the more scientific aspects of mycology. Professionally, Nero works as a magazine editor at an association nonprofit. She holds bachelor's degrees in journalism and French from the University of Mississippi and is a member of the Phi Beta Kappa Society. Having grown up in a science-forward household (her father and grandfather are biologists), Nero is pleased to get back to her roots (or, shall we say mycelia?).

I am confident Willow will continue our long tradition of excellence and develop McIlvainea as a preferred publication for young mycologists. We thank Michael Beug for his excellent "temporary" stewardship of our peer-reviewed journal.

On Waxcaps

by Else C. Vellinga, ecvellinga@comcast.net

One of the surprising sights in the North American forests is waxcap species – the colorful members of the genera *Hygrocybe*, *Cuphophyllus*, and *Gliophorus*.

I started my mycological career in the Netherlands, where waxcaps grow in grasslands: un-fertilized, non-disturbed, non-production, so-called unimproved grasslands. That runs true for the rest of northwestern Europe; waxcaps grow in grasslands, species of the genus *Hygrophorus* in forests. They are good indicator species for the grassland's health (health in a biological diversity sense). Such grasslands have become very rare in the last century due to an overwhelming desire to fertilize the mushroom-rich grasslands, and change these into uniform grasslands that become production units for cattle; the high levels of nitrogen deposition in general also form a severe threat to this habitat. These grasslands not only sport a fair number of Hygrocybes, but also earth tongues, *Clavaria* and *Clavariopsis* species, and Leptonias are well represented. All these species can be found here in California in the coastal redwood forests and Monterey cypress plantations in great numbers.

A parrot mushroom (*Gliophorus psittacinus*) from the redwood forest.

Though waxcap species grow in the California forests, they also can be found in grasslands. One example is a species described by David Largent under the name *Hygrophorus subbasidiosus*: a grey-brown species that nowadays would be placed in *Cuphophyllus*. This was found on a shaded lawn near the biology building on the UC Berkeley campus in January 1939. Fertilizers, and a vigorous herbicide spraying attitude have changed the campus lawns into dark green monotonous grassmats, where only *Panaeolus foenisecii*, the haymaker's fungus, and *Bolbitius titubans* (sunny-side-up) are regularly found.

As soon as waxcap rich grasslands are treated with fertilizers, herbicides, or other "cides," and as soon as the sheep or cattle that keep the sward short are removed, waxcap species will cease to fruit. It can take years before the original richness in fruitbodies is restored. In the UK, waxcap species have become the flagship of conservation efforts for those grasslands, as they are colourful and easy to recognize as a group and hence highly charismatic.

These fungi raise some interesting questions that have puzzled scientists over the last 10 years. What do they live from? Why are they so sensitive to disturbances such as fertilizers? And how is it possible that these species are grassland species in northern Europe, and yet, do so well in woods and forests in North America?

You have to realize that scientists have not yet discovered how to grow these fungi in culture. Their spores can germinate in the lab, but only a small percentage does so, and only from a few species. *Cuphophyllus virgineus* spores are exceptional in that they germinate in reasonable numbers, and of all waxcaps, this species is the most tolerant to disturbances.

The Northern European grasslands are artificial habitats; they exist only because of management measures such as grazing and mowing. A grassland left alone changes rapidly into a woodland. By looking at grasslands in this way (as thwarted woodlands), forests and grasslands are no longer that different. Waxcap species can then be considered as "leftovers" from the pre-grassland forests.

Hygrophorus is a close relative of the grassland waxcap species and its lifestyle is well known. *Hygrophorus* species are truly ectomycorrhizal with various tree species; that is, the mushrooms get their sugars from the tree, and the fungus scavenges for nitrogen, which it will deliver to the tree. The exchange of these goodies takes place in the tree roots, with the fungus growing around and into the roots, but never penetrating into the cells. *Hygrophorus hypothejus* is a typical pine associate, and you will find *H. roseibrunneus* under oaks.

However, it is much less clear how the waxcap species get their carbon and their nitrogen. They are not ectomycorrhizal, as ectomycorrhizal hosts neither occur in these grasslands nor in the redwood forests, and they don't form the typical ectomycorrhizal structures around the roots of trees.

The profiles of nitrogen and carbon (sugars!) uptake of waxcaps differ considerably from those of saprotrophic fungi that break down dead plant material. Waxcaps possibly get their nitrogen from humus, but their sugars come from living plants, just as for ectomycorrhizal fungi.

But which plants could that be?


A waxcap (*Hygrocybe*) from a Monterey cypress planting.

Two recent studies have looked at plant roots: grass roots and the roots of *Plantago lanceolata*. To our surprise, the hyphae of waxcaps were found within these roots. So now it is thought that waxcaps get their sugars from living plants, but not from ectomycorrhizal trees. This is still an hypothesis, as it has not directly been shown that sugar from the plant ends up in the mushroom.

This idea also leaves lots of room for questions, as waxcaps are found in grasslands and in woodlands. In fact, I don't see grasses in the redwood forest that much, or under Monterey cypress where the *Hygrocybe* photo was taken. But there is always ample poison oak around; could that be the source of sugars for the waxcaps??? Mosses have also been postulated as sugar providers, and that might be the case in grasslands, or in mossy eastern North American forests, but look again at the photo of the Monterey cypress waxcap, where mosses are definitely absent.

One other piece of information that might be relevant is that many species in the family Hygrophoraceae are lichens, in which the fungus forms a symbiosis with green algae (this is the case for *Lichenomphalia*), or with cyanobacteria (tropical *Dictyonema* species). The algae and cyanobacteria are enslaved by the fungi to provide the sugars on which the fungus thrives. Moss-inhabiting *Arrhenia* species are in this same family, but also the beauti-

So, instead of getting clear answers on the questions about the ecology of the waxcaps, we are confronted with a plethora of nutrition modes within one natural group of fungi and more questions about the evolutionary history and the biology of these fungi than ever.

There is quite a list of articles now that delves into the various aspects of the Hygrophoraceae, plus a few websites that give information. I want to point you to two papers that are relevant for aspects other than ecology: The first is on the phylogeny of the whole family (by Lodge et al., 2014). The second is a small article that studied some closely related British waxcap species in depth. These species differ in colors, but are for the rest very similar. A small part of DNA of differently colored specimens was compared; this particular piece of DNA does not cause the different colors, and yet, there is a correlation between color and the signature in this part of the DNA. So far two new species were described based on this study. DNA variation among different parrot mushrooms (*Gliophorus psittacinus*) was also detected, and this might have implications for the names we use for the western species. We have probably several species of parrots, and none the same as in Europe!

Further reading:

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Griffith GW, Easton GL, Jones AW. 2002. Ecology and diversity of waxcap (*Hygrocybe* spp.) fungi. *Bot. J. Scotl.* 54: 7–22.

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Seitzmann BH, Ouimette A, Mixon RL, Hobbie EA, Hibbett DS. 2011. Conservation of biotrophy in Hygrophoraceae inferred from combined stable isotope and phylogenetic analyses. *Mycologia* 103: 280–290.

Tello SA, Silva-Flores P, Agerer R, Halbwachs H, Beck A, Peršoh D. *Hygrocybe virginea* is a systemic endophyte of Plantago lanceolata. *Mycological progress* DOI 10.1007/s11557-013-0928-0

http://www.kew.org/news/conserving-british-waxcap-fungi.htm

http://www.aber.ac.uk/waxcap/index.shtml – very useful web site – lots of links

Else Vellinga works at the herbarium of UC Berkeley on the digitization of the fungal collections, and does mycological research in the Bruns lab, also at UC Berkeley. She is interested in systematics, taxonomy and ecology of the fleshy fungi of California and beyond. She loves parasol mushrooms (Lepiotas), but also has published on elfin saddles, Suillus *and* Paxillus *species.*

The Names They Are a-Changin':
A Primer on Modern Phylogenetics and Classification

by Carl de Boer, Editor of *Mycelium*

(This article was first published in *Mycelium*, the newsletter of the Mycological Society of Toronto, Vol. 40, No. 2 April-June 2014)

Beginning about two decades ago, scientists started using molecular data to redefine taxonomic groupings; species seem to be bouncing from genus to genus. This has lead to a general confusion among amateur mycologists. Here, I briefly describe the motivation and basis for these changes in hopes of increasing understanding of this process.

Taxonomic classification is the grouping of organisms into a hierarchy based on common organismal traits. For instance, *Amanita muscaria* is contained within the genus *Amanita*, a group of mushrooms that typically have an annulus, a volva, and a white spore print. The genus *Amanita* is contained within the order Agaricales, which contains most of the gilled mushrooms (although not all - see below), including *Cortinarius*, *Agaricus*, *Tricholoma*, *Marasmius*, *Hygrophorus*, *Pluteus*, and many others. Higher still, is the phylum Basidiomycota, containing the fungi that produce their spores on basidia, including the agarics, polypores, and jellies. Above that is the kingdom Fungi, the group of organisms that typically (though perhaps not in all cases) have cell walls made of chitin, which also contains the Ascomycota (fungi with asci - sac fungi), and several other less-recognizable groups (e.g. chytrids, which include the species responsible for the global amphibian decline). This yields a hierarchy of groups, where at each level, all the organisms within that group share some set of traits defining the group.

Long ago, people determined that organisms fall into hierarchies of similar organisms. Darwin's theory of evolution by natural selection gave a natural interpretation of these hierarchies: each group of organisms with similar traits evolved from a common ancestor. For instance, the genus *Amanita* arose millions of years ago with the mushroom that is the ancestor of all modern day Amanitas. Over the millennia, this single species would diversify and diverge, giving way to varieties, like those we have for *A. muscaria* today (e.g. *var. formosa*), and these varieties would eventually diverge to the point where they could no longer interbreed, at which point we would call them species. Fast forward to today, where we now have many distinct descendants of the original *Amanita*, and it is these species that make up the genus. By this process of divergence and speciation, repeated manifold over the millennia, we have our current complement of organisms. We classify these by what we think are their evolutionary relationships into the taxonomic ranks (e.g. genus, species, variety, family, order, etc.), where, in general, the further back in time the ancestor of the group lived, the higher up the hierarchy the taxonomic group lies.

However, our original taxonomic classification was based on observable traits (macroscopic or microscopic) so we sometimes failed to capture their supposedly 'true' evolutionary relationships. (Editor's note: As pointed out in correspondence with Steve Trudell, inasmuch as the fosssil record for fungi is almost non-existent, it could be argued we still do not have a clear understanding of fungal evolutionary relationships, despite what the proponents of DNA analysis would like us to believe). For instance, it would be erroneous to group together winged animals[1] (birds and bats) because birds and bats are only distantly related. The fact that these groups both have wings reflects independent adaptations in the two groups, a process called convergent evolution. So just because we can group organisms based on shared traits does not mean that these traits reflect the true evolutionary relationship.

We now have the technology to easily and cheaply sequence an organism's DNA and can then compare these sequences between organisms to see how they are related. Generally speaking, the more closely related two organisms, the fewer differences in the DNA sequence we expect to see between them.

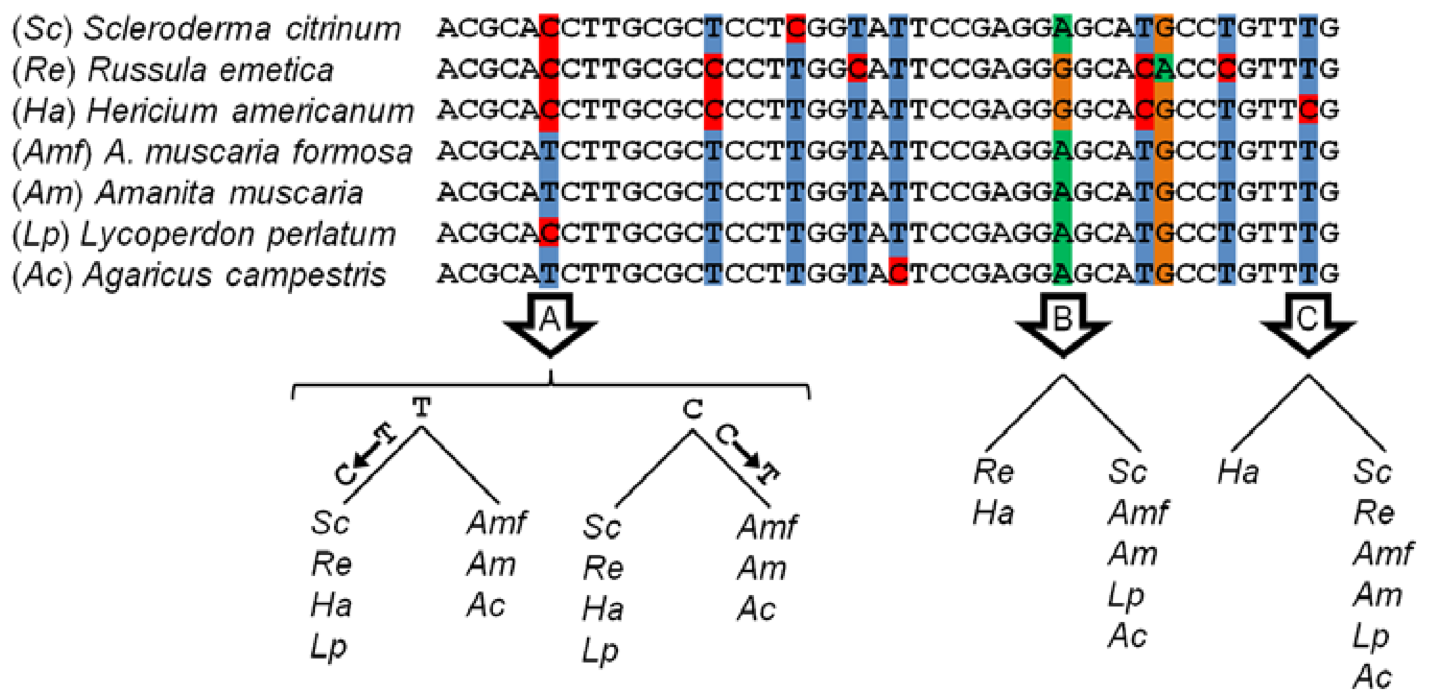


Figure 1: A sequence alignment (part of the 18S ribosomal gene) between different fungal species. Each row represents a different species and each column represents the bases in each species that correspond to the ancestral sequence. Colored columns indicate those where not all bases are the same, indicating a mutation has occurred in one or more of the species. Below are indicated three possible evolutionary histories inferred from the indicated mutations.

For instance, Figure 1 shows a short sequence alignment of several fungi. There are four different bases that make up DNA and we represent these by four letters: A, T, G and C. Figure 1 shows the part of the sequence for the same gene for different fungi, where these sequences are aligned such that the each column represents the same position. At many of the positions in this sequence alignment, the bases are identical between all seven species, indicating that this region is important to the survival of these species[2]. Because mutations are rare in general, it is unlikely for the exact same mutation to happen independently in multiple organisms. This way, we can infer groupings of organisms by dividing them into groups with a shared base. In position "A" in Figure 1, some of the fungi have a C and some have a T. There are two equally likely explanation for this finding: either the common ancestor of these species had a C at this position and in one lineage it was mutated to a T, or the ancestor had a T and in one lineage it was mutated to a C. Although it is also possible that one organism mutated from C to T and back again, this explanation requires two unlikely events instead of one, and in general we favor the simplest explanation. By combining the information contained in many different positions3, we can infer the evolutionary history of these mutations to yield a tree representing speciation, where the leaves represent the species, and anywhere two branches meet represents the last common ancestor of the organisms on each branch (Figure 2). By considering a greater number of species and sequences, we can achieve more robust phylogenies.

Changes in the DNA sequence do not happen in a vacuum; DNA is the genetic basis for organismal traits. For instance, there are one or more genes controlling whether or not a mushroom stains blue. In some cases, mutations may arise in one species that change the staining reaction, and traits such as these we can use to differentiate mushrooms in the field. Historically, we did not have access to DNA sequences, so we have had to group organisms by the traits they shared. What happens when these relationships are only coincidental? Enter mycology. It turns out that fungi are exceptionally difficult to classify into evolutionarily related groups on the basis of morphological features. Many of the groupings we thought were good lump together distantly related fungi. For example, the genus *Coprinus* originally grouped together mushrooms that deliquesced (their gills/caps dissolve). After sequencing these organisms, we discovered that several distantly groups of mushrooms independently evolved this trait, forcing us to divide the group into the four deliquescent groups we have now (*Coprinus, Coprinellus, Coprinopsis, Parasola*).

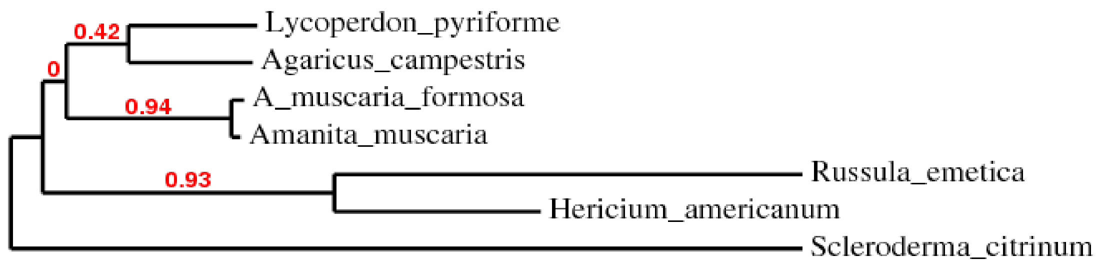


Figure 2. A phylogenetic tree representing the evolutionary relationship inferred from the complete set of mutations across the gene used for the alignment. Branch lengths indicate the evolutionary distance (generally, the number of mutations occurring on the branch). Numbers on the branches indicate our confidence that the branch is correct.* (That is, 'IF you believe that a statistical calculation can tell you what is biologically meaningful," cautions my proofreader Steve Trudell).

One of the unfortunate consequences of mycology's foray into molecular phylogenetics is that the names for the species keep changing; what was *Coprinus micaceus* one day is *Coprinellus micaceus* the next! Should you be worried? Probably not. The name changes usually fall within one of these three scenarios:
1) The species is good, but its placement is doesn't fall within the currently accepted construct (as with the *Coprinus* example).
2) The species is actually more than one species (as with the North American "*Morchella elata*").
3) A single species has been given more than one name (the oldest name takes precedent).
Scenario 3 is nothing new; species have often been described and named separately only to have someone later declare the names redundant. In scenarios 1 and 3, only a brief confusion is likely to result: furious debates about a mushroom's identity eventually leading to both sides realizing they're in agreement. For scenario 2, if there are traits that can be used to differentiate the new species, then there's no problem. Either you learn the new traits and move to the new names, or you lump them all together and stick with the old name. Often, there are no reliable methods for determining which of the several possible species a specimen may be (partly why they used to be considered a single species) so identification down to the exact species can be challenging. In this case, our identification was equally ambiguous with the old name, but we were ignorant of our mistake. In this scenario, I would simply record the specimen as the old name and if you're really ambitious, add "sensu lato" (in the broad sense) to the end. If questioned on this approach, simply reply "I left my DNA sequencer at home".

The names of mushrooms are likely to continue evolving until we have built up a robust phylogeny. Even then, mycologists are likely to continue arguing about where genus and species boundaries should be drawn. Whether you choose to use the new names or the old names is ultimately up to you, but as usage of the new names increases, so will usage of the old name decrease. You can, however, take comfort in knowing that the next generation of mycologists will be equally bemused when reading about "*Lepista nuda*", "*Coprinus atramentarius*", and "*Rozites caperata*".

FURTHER READING:

For a more practical discussion on this topic and how reclassification works in practice, see D Jean Lodge and Andrus Voitk, 2014, The birth and fate of new generic names. *Omphalina* Vol. V, No. 1.
For more information on DNA barcoding, see the corresponding Wikipedia article.

Footnotes

[1]. I actually mean vertebrates here, since I am excluding insects and many other animals.
[2]. The 18S gene is commonly used in phylogenetics precisely because parts of it are very highly conserved (i.e. the DNA sequence is identical even for very distantly related species). This allows us to use the same molecular "crosshairs" to sequence the same region for many species, making a cheap and easy approach. I will refrain from explaining details of the specific molecular techniques since it could (and does) fill textbooks. If interested, see "FURTHER READING" on DNA barcoding.
[3]. Actually, position C in Figure 1 is not informative since all we can say from a single difference is that one species is separated from the others, which we already knew. Consequently, the more sequences we have, the more robust our results (for the same reason position B would become uninformative if we dropped *Hericium americanum* from this alignment).

NAMA Seeks Executive Secretary

Unfortunately, Becky Rader, NAMA's Executive Secretary is stepping down at the end of this year. The Board of Trustees seeks a replacement for this important post. Nominations for this position are encouraged.
The Executive Secretary of NAMA is appointed by and serves at the discretion of the Board of Trustees for a three-year term, which may be extended subject to annual review. There is a stipend for this position; the current stipend is $5,000 per year, subject to modification by the Board of Trustees.
In essence the Executive Secretary reports to the President; responsibilities include managing the NAMA office, distributing correspondence and responding to inquiries, printing and distribution of association brochures, newsletters and other materials, along with assisting the board to organize and run the annual trustees meeting. If you are interested in receiving a more detailed list of responsibilities, please contact Martin Osis at martin@cris-se.com. If you are interested in applying for the position submit a brief biographical description of your qualifications and experience to Martin Osis, NAMA First Vice President, 67 River Drive, Devon AB T9G 1C2 Canada, or by email to: martin@cris-se.com. Nominations and required materials must be submitted prior to the start of the 2014 Board meeting in Eatonville, WA for distribution to the Trustees.

The person selected as Executive Secretary will be announced following the 2014 Board of Trustees meeting, assuming a qualified candidate will be found by then..

It Is Election Time Again!

This year, the positions up for re-election are **Treasurer** and **2nd Vice-President**. Both these positions play active and vital roles on the Board of Trustees and the Executive committee. The Treasurer's job is self evident and the 2nd V.P. role is to act as the chair of the nominating committee every third year (when the 1st V.P. position is up for re-election) and step in if the President and 1st Vice President are unavailable.

These two positions will be voted on by the trustees at this year's meetings at the Washington foray. As per changes voted on by the trustees at the Arkansas foray, the general membership will be voting directly on their Regional Trustees by email or mail in ballot later in the year. The regions that will be electing trustees this year are:

· Region 1: ME, NH, VT, MA, NY, CT, RI
· Region 2: PA, DE, MD, DC, VA, WV, NJ
· Region 4: KY, TN, AL, MS
· Region 9: WA, OR, ID, MT, AK

The regional trustees are the NAMA contacts for the area and bring a regional voice to the trustees meeting and generally, as all of you do, support the efforts and activities of NAMA vis-a-vis each region's mycology clubs.

If you are currently a regional trustee and would like to continue representing your region or would like more detailed information about what is involved please contact Martin Osis at martin@cris-se.com. Remember this is your organization and only you can make it better and stronger.

Martin Osis
Vice President
North American Mycological Association
www.namyco.org

Meat Eating Trees?

by Kent P. McFarland

(Reprinted with permission of *Northern Woodlands* magazine, August 26, 2013)

Plants are not often thought of as predators. They're the nice guys. With over 300,000 species known to exist, only a small fraction are known to be meat-eaters. In our northern bogs, for example, insects are trapped on the sticky hairs of sundew or drowned in the pitcher plant's water

Research now suggests that at least one tree may owe its size to more than just sun, water and good soils.

The eastern white pine is one of the tallest native tree species in our region. Give them a few hundred years in ideal floodplain habitat, with roots sunk deep into sandy and silty soils and protected from winds and lightning by hillsides, and they'll grow to over 200 feet tall with nearly eight foot diameter trunks.

It takes a lot of energy and nutrients for a tree to grow to such grandeur. One thing that might help the eastern white pine is its surprising relationship with a meat-eating fungus.

The bicolored deceiver (*Laccaria bicolor*) appears above ground as a small, tan mushroom with lilac-colored gills. It is found in most coniferous woodlands throughout temperate regions around the globe. The fungus has a symbiotic relationship with many trees, including the eastern white pine. It forms a mycorrhizal sheath, like roots of the fungus, around the small root tips of the tree. The fungus receives sugars from the tree's photosynthesis that takes place above ground, while it supplies the plant with essential nutrients and helps to increase water uptake by the tree roots from below ground.

Such symbiotic relationships between trees and fungi are common. About ninety-five percent of plants get some nutrients from fungi, and fungi play a critical role in the food web. In particular, fungi (along with lightning strikes and soil bacteria) are critical for converting atmospheric nitrogen into reactive forms, such as nitrate and ammonia, which other living things can use for growth.


Springtails

What makes the eastern white pine's relationship with the bicolored deceiver surprising is the way the tree benefits from the fungus' meat-eating habits. This discovery occurred by accident, during a study of tiny soil arthropods called springtails.

Many observers know springtails as snow fleas, the wingless insects often seen by the thousands jumping across the snow in late winter. They are incredibly small, but they can occur in huge numbers. Soil ecologists John Klironomos, now at the University of British Columbia, and his colleague Miranda Hart, wondered if springtails had an adverse effect on trees since they ate fungi that helped secure nutrients for many plants. They set up a simple experiment to feed the springtails a diet of fungi, including bicolored deceiver.

That's when their experiment took a strange turn. All of the springtails died when they were with bicolor deceiver. "It was as shocking as putting a pizza in front of a person and having the pizza eat the person instead of vice versa," Klironomos told Science News.

To confirm their findings, Klironomos and Hart fed a few hundred springtails a diet of bicolor deceiver while others were fed a diet either devoid of the fungus altogether or with another fungi species. After two weeks, only five percent of the springtails that were with bicolor deceiver remained alive. In contrast, nearly all the springtails that ate other species of fungi or whose diet was devoid of fungi survived.

The fungus was killing the springtails and breaking them down with a special enzyme. The researchers believe that the fungus first paralyzes the springtails with a toxin and then extends fine filaments into them to absorb nutrients.

So how does this make the eastern white pine tree a meat-eater? As a follow up experiment, Klironomos and Hart fed a batch of springtails a diet with nitrogen that was tagged using 15-N, a stable isotope, so they could follow it through the food web. The insects were added to containers of bicolor deceiver growing with white pine seedlings. After a few months they tested the seedlings and found that 25% of the nitrogen in the trees had come directly from the springtails. It's as if white pine were fishermen using the fungus like a giant net to capture their prey.

Now, new research from scientists at Brock University in Ontario suggests that this adaptation may be shared by many plants. *Metarrhizium anisopliae*, a soil-dwelling fungus found in many ecosystems, has long been known to infect insects. It has now been shown to associate with plant roots and transfer nitrogen from its insect prey to grass and even beans.

With webs of mycelia hunting tiny prey underground to help giants grow and capture the sun above, understanding who is eating whom just got a lot more complicated.

Kent McFarland is a biologist with the Vermont Center for Ecostudies. The illustration for this column was drawn by Adelaide Tyrol. The Outside Story is assigned and edited by Northern Woodlands magazine and sponsored by the Wellborn Ecology Fund of New Hampshire Charitable Foundation: wellborn@nhcf.org

Symbiosis in Fungi: Enforced surrender?

Science Daily, May 20, 2014

Scientists from INRA and Lorraine University in France unraveled a key mechanism in the symbiosis between fungi and trees. During this mutually beneficial interaction, the fungus takes control of its host plant by injecting a small protein that neutralizes its immune defenses thereby allowing the fungus to colonize the plant. This finding is a major advance in our understanding of the evolution and functioning of symbiotic interactions between fungi and plants -- relationships that play a significant role in supporting the health and sustainability of our natural ecosystems. These results are published in the advance online edition of the Proceedings of the National Academy of Science on 19 May 2014.

In the complex world of the rhizosphere -- the soil surrounding plant roots -- thousands of species of bacteria and fungi compete for resources released by plants. Some fungi, such as truffles and boletus, are able to live in symbiosis with plants through their roots, by-passing their competitors to obtain sugars directly from their host. In return, symbiotic fungi absorb mineral nutrients and then transfer them to the plant root; this improves the plant's health, vigor and productivity and allows the plant to live. Mycorrhizal fungi are one class of symbiotic fungi that make their way to plant roots where they negotiate for housing and all-you-can-eat sugar services. But how does this negotiation play out? Is the host plant able to distinguish between beneficial and parasitic fungi? How does the fungus avoid the plant's immune defenses during the interaction?

It's all about biochemical dialogue

Thanks to a global collaboration between INRA, Lorraine University, Oak Ridge National Laboratory and the University of Western Sydney, part of the molecular language used by mycorrhizal fungi was partially deciphered.

Plant roots are constantly releasing a diverse set of 'signal' molecules into their surrounding soil environment. Scientists studied a specific fungus, *Laccaria bicolor*, which perceives these molecules in the soil and enables fungal growth toward the plant root. The presence of a plant root also triggers the release of small proteins by the fungus. Generically called 'effectors', these small fungal proteins are bioactive molecular signals that prepare plant tissues for a symbiotic relationship. How these molecular signals prepare the plant host for symbiosis with a mycorrhizal fungus has remained clouded in mystery -- until now.

Effectors block the plant's immune defenses

The research consortium identified one of these effectors, MiSSP7, that binds a molecular switch which controls plant immunity. Normally, when a plant is attacked by a disease-causing microbe, jasmonic acid is one of the main hormones that immediately triggers a battery of defense reactions to kill off the invading organism. MiSSP7 neutralizes this defensive response by directly targeting the jasmonic acid-associated control switch of plant immunity. By hindering the plants ability to generate an immune response, MiSSP7 allow the fungus to develop within plant tissue where it can establish a fair trade for nutrients.

These findings show that beneficial microbes, rather than playing nice, are forcing themselves into the plant enacting a symbiotic relationship with the plant nefariously. Research is underway to identify if the other effectors of mycorrhizal fungi act similarly to control the host plant and force symbiosis.

Laccaria bicolor Photo by John Plischke III

Hearty "Hen" Soup

by Maxine Stone

4 - 6 servings

3 C. Hen of the Woods (*Grifola frondosa*), sliced
3 Tbs. butter
2 C. onion, chopped
3 Tbs. flour
1 C. milk
1-2 tsp. dill weed
1-2 tbsp. Hungarian paprika
1 tbsp. tamari
2 C. veggie stock or water
2 tsp. fresh lemon juice

Salt, pepper
Chopped parsley (optional)
Thick Greek yogurt (optional)

Saute the onion in 1 tbsp. butter over medium heat. Add the mushrooms, dill, ½ cup stock or water, tamari and paprika. Cover and simmer for about 15 minutes.

In a large pot, melt the remaining butter. Whisk in flour and cook a few minutes while continuing to whisk. Add milk. Cook over low heat until thick, stirring frequently, about 10 minutes. Stir in mushroom mixture and remaining stock, lemon juice, salt and pepper. Cover and let simmer for about 10 more minutes.

Garnish with chopped parsley and/or thick Greek yogurt.

This has a deep, delicious flavor. Serve it with salad and a good bread. Mmmmm.

Wildacres Foray 2014

The Wildacres 2014 Foray is scheduled for September 11-14, 2014. This foray is held at the Wildacres retreat center located just off the Blue Ridge Parkway near Little Switzerland, not too far from Spruce Pine, North Carolina. Mycologists this year are Brandon Matheny from the University of Tennessee, and Coleman McCleneghan from Boone, North Carolina and the Department of Biology at Appalachian State University. We are very thankful to have these two knowledgeable southern mycologists join us for this foray. Wildacres is renowned for the identification of new species to the foray and to the identification of new species to the mushroom kingdom. You will have the opportunity to search for fungi along the creek sides of Armstrong Creek and Crab Tree Falls, in the highlands of Mount Mitchell, and in many other areas along the beautiful Blue Ridge Parkway. This intimate gathering is sought after by professional and amateur mycologists from across the country. Please register soon as this foray is a sell out each year. Please contact Glenda O'Neal, (423) 246-1882 for more information. Registration fee for this foray is $235 per person and includes three nights lodging and eight meals-double occupancy.

RESUPINATE FUNGUS SHOWN ON A POSTAGE STAMP

by Brian S. Luther

(This article was first published in the Puget Sound Mycological Society's newsletter *SPORE PRINTS No. 502, May 2014)*

Countries around the world issue postage showing a large variety of attractive subjects (called topicals in philately), expecting to sell a lot of them to collectors. Because resupinate fungi are obscure and never collected or even seen by most people, they've never been featured on stamps—until now.

In 2013 Macedonia issued a gorgeous four-value set of stamps featuring fungi, one of which is the cobalt blue resupinate *Terana caerulea*. Macedonia (a former Yugoslav republic) is sandwiched between Albania to the west, Kosovo and Serbia to the north, Bulgaria to the east, and Greece to the south.

Terana caerulea, previously put in the genus *Pulcherricium*, is widespread in the Northern Hemisphere on hardwood debris. It's known from eastern North America (I used to find it in the Southern Appalachians), but it's not known from western North America, except for Arizona. The only reason Macedonia illustrated this resupinate on a stamp is that it's a stunning blue color. As you can see from the photo, the mini-sheet with these stamps is quite colorful, having two sets of the four stamps and also showing the same fungi on the selvage (non-stamp margin).

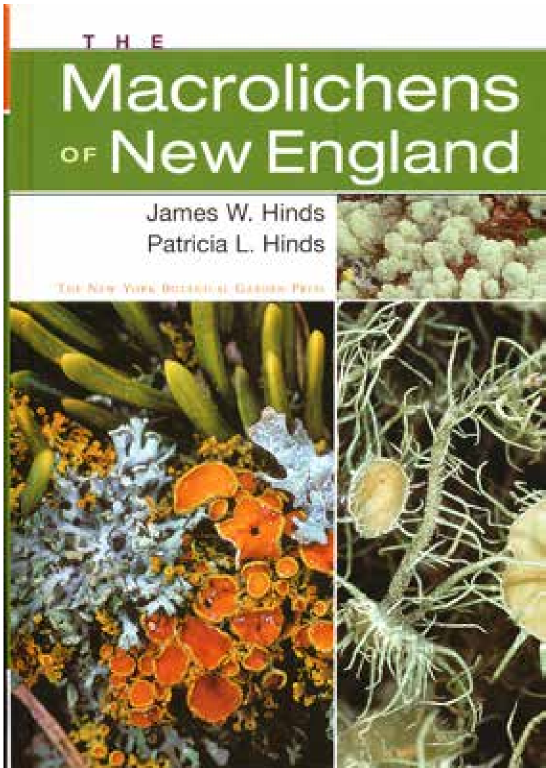
NAMA Mycological Communication Contest Deadline January 15 of Each Year

NAMA is seeking ways to encourage and assist students in their development as mycologists by providing writing and public speaking opportunities. To that end, NAMA has initiated an annual mycological communication contest for students K-12 through Post Doc.

Effective communication with the lay public about scientific discoveries and observations will help engender public interest in and support for both basic science and for the environment where we conduct our research. To encourage communication by students doing mycological research, NAMA is soliciting student research papers for publication in *McIlvainea: Journal of American Amateur Mycology*. All students who submit a paper will receive a one-year membership in NAMA. A $250 prize will be awarded to the author of the best paper in each of four categories: 1) best paper by a K-12 student; 2) best undergraduate paper; 3) best graduate/post doctoral paper and 4) judges option award (any category). In addition, the winners will be invited to attend the NAMA Annual Meeting/Foray and present their work at a student mycological colloquium. Winners who choose to attend the NAMA foray will each receive a $500 stipend to help cover registration, travel, meals and lodging.

In the event that no entries are received in a given category, the judges may make an additional judges option award.

Entries must be submitted to Michael W. Beug, beugm@evergreen.edu.



The Macrolichens of New England

James W. Hinds and Patricia L. Hinds
Memoirs of the New York Botanical Garden Vol. 96
The New York Botanical Garden Press, 2007
http://www.nybgpress.org
ISBN 978-0-89327-477-1 (hardcover, 608 pages, over 400 color photographs, 10" x 7")
$65

Just as has been happening with mushrooms, well illustrated regional books about lichens are becoming more common. For anyone in the northeastern U.S. or southeastern Canada with a more than passing interest in these dual or tripartite organisms, this is a must-have volume. It covers the so-called "macrolichens," which includes the leafy, fruticose, and squamulose species and excludes the crusts.

Husband and wife Jim and Pat Hinds are life-long Northeasterners, currently living in Maine. Both have backgrounds in academic research, became interested in lichens as a rather serious avocation, and have been at it for over 40 years now.

The front matter, which includes the preface, discussion of the illustrations, summary of the coverage, and the acknowledgments, is followed by over 70 pages of explanatory text covering a wide range of lichen topics. These include Morphology, Anatomy, and Reproduction of New England (NE) Macrolichens; Ecological Role of NE Lichens; Human Uses of NE Lichens; Biophysical Regions of NE and their Lichen Floras; Changes in Abundance and Distribution of NE Macrolichens during the Last 100 Years; Rare or Declining Macrolichens of NE; How to Collect and Identify Macrolichens; and Crustose Lichens of NE. This material goes beyond that typically included in a field-guide type of book (given its thickness [over 600 pages], weight [I estimate 3 lb or more], and hard cover, it would be hard to call this a field guide), addressing many interesting aspects of the lichens and the area in which they live. It is well written and the information is well researched, with many sources cited.

This is followed by Introduction to the General Keys and the General Keys to NE Macrolichens. Rather than having one long key to over 500 species, the Hindses chose to develop 50 short keys, usually based on readily observable characteristics such as substrate, growth form, color, and presence/absence of soredia and isidia (two types of vegetative reproductive propagules). A quick key index presented here and repeated inside the front cover is used to determine which of the 50 keys is appropriate for the lichen in hand. Getting familiar with this index and proficient in its use clearly will be important for achieving identification success. The leads in the 50 keys typically include macroscopic features, the usual lichen macrochemical reactions, and locational information. The keys include all 461 species recorded from New England, as well as another 41 that occur in neighboring states and possibly in New England as well. A nice feature is the yellow highlighting of names used to indicate the more common species (263 of them).

Following an explanatory Introduction to Genus and Species Descriptions are over 400 pages of descriptions of nearly 100 macrolichen genera and over 450 species, including 86 cladonias(!). The descriptions are arranged alphabetically, first by genus and then by species epithet. Each genus description is followed by a key to the species in the genus. The species descriptions include the name with brief authority, an English name, reference to its illustration(s) (in other books if not included here), synonyms, indication of any misapplied name(s), the descriptive information including chemical reactions, range and habitat, and miscellaneous notes, which usually consist of a sentence or two. Just over 300 of the species are illustrated with a decent-sized, very-good-quality color photo. Most of them are of fairly generous size (up to ~4.5 inches long dimension).

The book concludes with Literature Cited (19 pages), Abbreviations, Glossary, two Appendices (Key to the Major Photobionts in NE Macrolichens and Excluded Species), and separate indexes to Latin and English names. The production is of high quality throughout and the price is reasonable.

As indicated at the outset, if you live or spend time in or near New England and are interested in knowing its lichen funga, this is a book you should own. But what if you already own the earlier gem, *Lichens of North America* by Brodo, Sharnoff, and Sharnoff (reviewed in the May-June 2002 *Mycophile*). After all, it is a rather comprehensive (and heavy!) volume with absolutely stunning photos. Well, the Hinds book covers about 140 species that aren't included in Brodo (other than a mention in comments in some cases) and there are photos for nearly 70 of these, so for the best coverage of the area, you need this book too. And, by the way, for those who don't yet own it, having Brodo also will be valuable as it has photos of over 70 species that are described, but not illustrated, in Hinds and includes crustose species, not just macrolichens. In addition, approximately 240 species are illustrated in both books and having two photos helps one appreciate the variation within a species. Bottom line is you need both books if you're serious about learning the New England lichens.

Steve Trudell

Mushrooms of the Midwest

Michael Kuo and Andrew S. Methven
2014
University of Illinois Press
Urbana, Chicago, and Springfield
$39.95 Paperback

This 427 page, 8"x10" book covers over 500 species of fungi illustrated with nearly 900 color images. Most fungi are illustrated with an image of roughly 2.5" x 3.5," sometimes supplemented with a smaller image of spores through the microscope, a close-up detail, a spore print, a habitat view or an image showing a macro-chemical reaction.

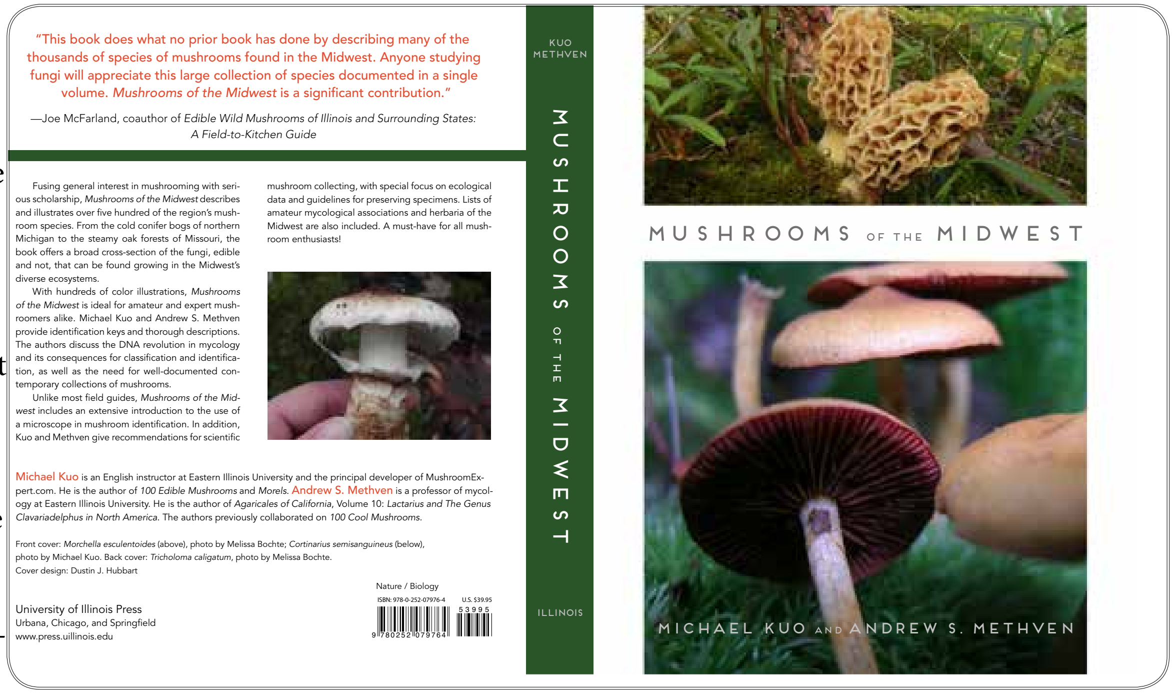
The book begins with a seven-page introduction describing how to use the book, the specific coverage area, mushroom clubs in the area, and recommended mushrooming locations. The authors make it clear that while they discuss edibility and toxicity, the mushrooms themselves are "infinitely more important and interesting than the question of whether they can safely pass through the human digestive system."

The second chapter has seven pages on collecting, documenting and preserving specimens, including a list of herbaria in the region where the fungi are deposited.

The third chapter (six pages) introduces using a microscope to study fungi.

Pages 22-79 are the identification keys for the included fungi. The keys appear to work quite well. They begin with a two-page key to the major groups of fungi followed by 18 keys to the specific groups.

The fungi appear in alphabetical order on pages 80 through 396. There are one to two species per page. Descriptions start with the ecology and end with brief comments. In most cases, spore color, size and shape are the only microscopic features given. However, when other microscopic features are important in the identification, those features are included. If the mushroom produces a color with KOH or the spores are amyloid, that fact is mentioned.



Chapter 6 is a four-page evolutionary picture. The authors have used the latest DNA data at the time that their book went to press for both the names that they use in Chapter 5 and the evolutionary tree that the present in Chapter 6. They make it clear that they have chosen to present the fungi in alphabetical order since our understanding of phylogenetic relationships is ever evolving. The tables in Chapter 6 are presented as the current snapshot of how mycologists see the relationships between the species that the authors have included in this book – a picture that is ever evolving.

If you are interested in fungi and live in the Midwest, you will definitely want to purchase this book. Since there are a number of included species that are not in other mushroom books, and since a great many of the included species occur in other parts of North America, anyone with a serious interest in fungi will want to add *Mushrooms of the Midwest* to their collection. It certainly has earned a place on my bookshelf even though I do not collect in the Midwest.

Michael Beug

Wanted! The Cat's Tongue, *Pseudohydnum gelatinosum*

Keep your eyes open for this jelly, photograph it in the field, make notes where you found it, on what kind of wood, on small branches, on the top or the side of big logs, and write down the trees around it, dry it on a mushroom drier (yes, it turns to nothing but that is enough to work with), and send it to Berkeley.

Else Vellinga
Bruns Lab
111 Koshland Hall #3102
UC Berkeley
Berkeley 94720-3102
USA

NAMA Memorial Fellowship:

Marisol Sánchez-García

The NAMA Memorial Fellowship is awarded annually to promising graduate students in mycology. Applicants are evaluated on the basis of their scholastic merit, research ability and promise shown as a mycologist.

Marisol Sánchez-García received a B.S. in Biology and a M.S. in Systematics from the Universidad Nacional Autónoma de México (UNAM) where she worked on the systematics of the genus *Melanoleuca* under the supervision of Joaquín Cifuentes. She is now a PhD candidate at the University of Tennessee working with Brandon Matheny. Her current research focuses on the systematics and evolution of the Tricholomatoid clade, and she is particularly interested in studying diversification patterns within this clade and the genetic changes that underlie transitions from saprotrophic to ectomycorrhizal fungi.

Marisol Sánchez-García Recpient of the NAMA Memorial Fellowship

NAMA Memorial Committee: Antonio Izzo, Chair; Julie Kerrigan; Tim James; Tom Horton; Imke Schmitt, *ex officio*, Past Chair.

North American Mycological Association
c/o Ann Bornstein
61 Devon Court
Watsonville, CA 95076

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Newsletter of the North American Mycological Association
THE MYCOPHILE

Tricholosporum tropicale Photo by Alan Rockerfeller

Tricholosporum tropicale is a rare mushroom from the cloud forests in Southern Mexico. Described from Oaxaca, this collection was made at Nevado de Colima, Jalisco, Mexico. It is unusual for its striking purple color and its cross-shaped spores. According to the locals, it is edible.