

Newsletter of the North American Mycological Association

Mychorrhizae Explained Pg.14

NAMA Annual Foray at Paul Smith's College Starts August 8th!

Barbara Ching

We're going to have so much fun and meet so many new mycofolks! As I write this, 214 of you have registered; 72 will be attending your first annual foray! 36 of our clubs have members attending; 28 states (plus D.C.), 2 Canadian provinces and 1 European country are represented. By the time you read this, the foray will be about 90% full — which means you still have time to register. Use this link https://www.namyc.org/2019_nama_paul_smiths_foray.php

And how many mushrooms will attend? While we can never guarantee a bumper crop, conditions are on target for an abundance of our shared obsession; the Adirondacks saw comfortably average rainfall during the month of June (3.65 inches), with July's precipitation forecast by AccuWeather as between 3 and 5 inches — and thunderstorms are predicted toward the end of August's first week!

Bring some treasures to donate to the silent auction, too. This year, we've decided to expand this tradition by encouraging you to bring all sorts of prizes to help raise funds. Of course, mushroom-related items will draw lots of attention but any other items that you think will attract bidders are also welcome. We will use the proceeds from the silent auction to sponsor students attending the 2020 foray.

Start planning your mushroom-devoted days now. Here's the working daily schedule; in a perfect world, it wouldn't change. In our world, though, there's a good chance that some rearranging could happen. The important thing is that we'll have 3 wonderful days to learn more about mushrooms and to be mycophiles together! Here's the perfect thing to wear; order it from the registration link above or buy one at the foray.



Schedule of Events

Thursday, August 8th

Registration opens 10:00 AM

Silent Auction Set Up

Vendors set up 12:00-5:00

Joan Weill Adirondack Library

Pine Room/ Joan Weill Student Center

Lobby Joan Weill Student Center

Lunch 12:00-1:00 PM

Board Meeting 1:00 -3:00 PM

Joan Weill Student Center

Pine Room / Joan Weill Student Center

Early Bird Foray 3:00-4:30 (Easy)

Early Bird Foray 3:00-4:30 (Easy)

Red Dot Trail (across from campus entrance)

Blue Dot Trail (meet behind gyms, entrance 100 feet down
Keese Mills Road)

Dinner 4:30-6:00 PM

Friday Foray Sign-Up 6:00-6:45 PM

Joan Weill Student Center

Pine Room / Joan Weill Student Center

EVENING PROGRAM:

Evening Presentation 7:00 PM

Intro Sam and Barbara 7:00-7:30

Andy Wilson, Voucher Committee 7:30-7:45

Rick van Der Poll 7:45-9:00

Saunders Sport Complex

Welcome to all.

How and why to voucher your specimen

“Mushrooms of the Great North Woods”

Social/Cash Bar 9:00-11:00

Bobcat Lounge and St. Regis Room/Joan Weill Student Center

Friday, August 9th

Breakfast 7:00-8:30

Joan Weill Student Center

Silent Auction Open 9:00-9:00

Pine Room / Joan Weill Student Center

Registration Open 9:00-3:00

Joan Weill Adirondack Library

Half-Day Foray 8:30-11:15 (Easy)

Half-Day Foray 8:30-11:15 (Easy)

Full-Day Foray 9:00-4:15 (Difficult)

TBA

TBA

TBA

ALL TALKS IN PICKETT HALL: ROOMS 101,112,113

Gary Gilbert 9:00-11:30 Pickett 102

Beginner's Class

Tom Huber 9:00-10:10 Pickett 112

Rick Van der Poll 9:00-10:10 Pickett 113

Psilocybin-Assisted Psychotherapy: Perspectives & Practices
Squamanita: Chasing the Fungal Sasquatch through the
Adirondacks

Matthew Schink 10:30-11:40 Pickett 112

Jan Thornhill 10:30-11:40 Pickett 113

Ganoderma of the United States

The Big World of Tiny Fungi

Lunch 1:30-1:00

Joan Weill Student Center

Half-Day Foray 1:00-4:15 (Easy)

Half-Day Foray 1:00-4:15 (Easy)

TBA

TBA

John Plischke III 1:00-4:00 Pickett 102/Campus

Photography Workshop

Long Litt Woon 1:00-2:10 Pickett 112

Bill Yule 1:00-2:10 Pickett 113

The Way Through The Woods. Of Mushrooms and Mourning.
An introduction to Mycorrhizal Symbiosis for beginners.

Ethan Crenson 2:30-3:40 Pickett 112
Olga Tzogas 2:30-3:40 Pickett 113

Salma St. John 3:30-4:45

Table Talk with an expert 3:30-4:40

Dinner 4:30-6:00

Farm to Table Dinner 5:00-6:30

Saturday Foray Sign-Up 6:00-6:45

EVENING PROGRAM

Barbara/ Sam 7:00-7:25

Andy Wilson 7:25-7:35

Roy Halling 7:40-8:15

Olga Khmelnitsky 8:15-9:00

Social/Cash Bar 9:00-11:00

Saturday, August 10th

Breakfast 7:00-8:30

Silent Auction Open 9:00-6:30

Full-Day Foray 8:30-4:15 (Moderate)

Half-Day Foray 8:45-11:15 (Easy)

Half-Day Foray 9:00-11:15 (Moderate)

John Plischke III 9:00-11:30 Pickett 102

Tom Horton 9:00-10:10 Pickett 112

Kay Hurley 9:00-10:10 Pickett 113

Kathie Hodge 10:30-11:40 Pickett 112

Roz Lowen 10:30-11:40 Pickett 113

Lunch 11:30-1:00

Half-Day Foray 1:00-4:15 (Easy)

Half-Day Foray 1:00-4:15 (Easy)

OlgaTzogas/John Michelotti 1:00-3:30 Pickett 102

Tim Baroni 1:00-2:10 Pickett 112

Sue Van Hook 1:00-2:10 Pickett 113

Elinoar Shavit 2:20-3:40 Pickett 112

Walt Sturgeon 2:30-3:40 Pickett 113

Table Talk with an Expert 3:30-4:40

Pyrenomycetes Large and Small (But Mostly Small):
Mushrooms + Fungi of Greece

Mushroom Culinary Arts; a demo and tasting / Cantwell 106

Buxton Gymnasium (Collection Room) Various experts

Joan Weill Student Center

Reservations required for 25 people \$45-\$55 The Ganzi
Restaurant. Contact

Pine Room / Joan Weill Student Center

Saunders Sport Complex

Foray Business

“Finds of the Day”

Mentoring in Mycology – A Bolete Story

Making it in Mycology: The High School Researcher Experience

Bobcat Lounge & St. Regis Room / Joan Weill Student Center

Joan Weill Student Center

Pine Room / Joan Weill Student Center

TBA

TBA

TBA

Chemical and Reagent Workshop

Why *Suillus* and *Rhizopogon* are very good, or bad, co-invasive
species with pine in the Southern Hemisphere.
Lichen Identification – Removing the Mystery

The Little Fungi in Our Lives

Tales of Interesting Ascomycetes

Joan Well Student Center

TBA

TBA

Hericium Cultivation and Tincture Workshop

Hunting Wild Mushrooms in Northeastern North America –
a pleasure not to be missed

Regenerating the Soil Sponge: what’s mush love got to do with
it?

Fossilized mushrooms in amber and copal: A fantastic voyage
“Appalachian Macrofungi”. Some common and uncommon
fungi found in the Appalachian mountains and foothills.

Buxton Gymnasium / Collection Room

Mycophagy 3:00-4:30

106 Cantwell Hall

Dinner 4:30-6:00

Joan Weill Student Center

Silent Auction Ends 6:30

Pine Room/Joan Weill Student Center

EVENING PROGRAM

Barbara/Sam 7:00-7:20

Andy Wilson 7:20-7:30

John Plischke III 7:30-7:45

Barbara/Walt Sturgeon 7:45-8:00

Gavin McIntyre 8:00-9:00

Foray Business/Announcing 2020 Location

Finds of the Day

Photo Contest Results

Awards

“The Future is Grown: Mycelium Materials”

Social/Cash Bar 9:00-11:00

Bobcat Lounge and St. Regis Room/Joan Weill Student Center

Sunday, August 11th

Breakfast 7:00-8:30

Joan Weill Student Center

Check out of rooms 9:00-10:00

Collection Walk-around 10:00-11:30

Buxton Gymnasium

Clean up/Depart 11:30-1:00

Topical *McIlvainea* Publications for 2019

While another wet beginning to summer beckons us to forage, keeping abreast of the exploding interest in all things mycological is equally compelling. *McIlvainea* has received submissions covering several areas. The 2019 volume begins with a cover image of a Taoist master clutching a *Ganoderma*, by the artist Chen Hongshou (1598 – 1652). This is a fitting introduction to two comprehensive papers by Dianna Smith: the first covering the long and complicated history of *Lingzhi* use (or not) in China; the second, a related paper, dealing with the medicinal use of both micro- and macrofungi, especially the poorly understood pharmacological properties of the latter. A related submission is from Michael Beug, Chair of the NAMA Toxicology Committee, on measuring oxalates levels in chaga (*Inonotus obliquus*) as relating to their depletion of calcium in the human body. A voucher report for the October 2018 NAMA foray near Salem, Oregon is given by Dr. Patrick Leacock; 362 voucher collections were preserved from the foray and these vouchers, with accompanying photographic images, are available online at the Field Museum and at <http://mycoportal.org>.

Lastly, we have included a comparative research thesis from Tim Prokesh on oyster mushroom cultivation using wax-coated vs. uncoated cardboard waste.

See the 2019 volume here: <https://www.namyco.org/mcilvainea.php>

I have also begun scanning back issues of *McIlvainea*. Volumes 1(1) 1972 and 2(1) 1975 have already been posted on the webpage by NAMA President Emeritus David Rust, with a listing of each volume's table of contents. I am delighted to note that these scans are keyword searchable!

The search for content for the current *McIlvainea* volume is ongoing, so authors are encouraged to submit. Submissions will reach me at laurajust54@gmail.com. Instructions for paper formatting are given on the NAMA website under the “Publications” tab, “*McIlvainea* Contribution Instructions.”

Laura Juszczak, *McIlvainea* editor

On The Decline of Alphataxonomy

Danny Newman

The following is a rant on the subject of the decline of morphological taxonomy and taxonomists in mycology. The 4% of you still reading may continue to the next line.

We all seem to recognize and agree that there is no longer any job or academic post in the world that will pay a person to go out and look for, find, describe and study fungi, at least not regularly, and not without tacking on a litany of other responsibilities, be they administrative tasks, the teaching or taking of unrelated courses, the writing and obtaining of grants, or self-flagellating upon the altar of impact factor. After 12 years of conversations with people in professional mycology, I've concluded that these add-ons constitute the bulk of their jobs, and that mycology — particularly *field mycology* — is the add-on. Naturally, that can only go on for so long before mycology fundamentally changes, at least in academia, and certain aspects of the field start to change and disappear.

What I see vanishing most rapidly everywhere I look are the classical components of taxonomy. The number of people who can competently put the International Code of Nomenclature (ICN) to use to create new, correct existing, or better govern nomenclature; the number of people who deeply understand and can readily recognize the salient macroscopic, microscopic, chemical and ecological features that are characteristic and diagnostic of one or more fungal groups; the number of people who have a deep working knowledge of past, present and possible future concepts of how their fungi have been/are/will be/should be delimited — is dwindling. People in command of all of those skills, resources and information are sometimes referred to as alphataxonomists. Alphataxonomists, therefore, are dwindling. Of the few who are left, the majority are at or above retirement age (which is when they tend to finally be able to do the work that their academic career perennially got in the way of), and they are seldom being replaced by those imbued with their knowledge and experience.

It is not enough to have any number of dozens or hundreds or thousands of less-experienced people still around when the alphataxonomists go extinct, because the training they received is a necessarily dynamic and interactive process that takes years to complete (if such a thing is ever truly completable). Once these alphataxonomists are gone, it will be much harder than we realize to revive their craft from nothing more than the texts and collections and libraries they've left behind.

The best, briefest exercise I can think of to demonstrate what I mean is to pick a page in this Rolf Singer article: https://www.zobodat.at/pdf/Sydowia_4_0130-0157.pdf

and start reading. You will be outdone and undone by Singer. Almost everyone is. To call his premolecular mastery

of macrofungi and their interrelationships “encyclopedic” would be a major understatement. If I could pick three people, living or dead, to spend one day each with, I would spend a long weekend with Rolf Singer. There is undoubtedly overlap in the fungi he and I have observed and collected, having covered much of the same terrain, but being a young and still inexperienced parataxonomist*,

I struggle to lift enough meaning from Singer's fifth-dimensional descriptions and comments to be able to paint a visual picture in my head, and then match that picture to anything I've seen (we won't talk about his drawings). For reasons outside the scope of this rant, I've not been able to appreciate and compare his microcharacters to my own material, but I've no reason to think this would be any easier. One walk in the Andes or Amazon with Rolf Singer could save anyone interested in Neotropical fungi anywhere from hours to years of labor in identifying described species and recognizing novel ones, but to attempt the same with what's *left* of the late Rolf Singer could take a lifetime. It is taking a lifetime — my lifetime.

Singer is far from the sole occupier of this echelon of mycological taxonomy. I use him as an example principally for his proximity to my research interests. Other juggernauts occupy his rank to varying extents in the level of intricacy, vastness, and attention to detail evident in their work.

The commonest cry to put these cares to bed is that the molecules will save us. Like so many weekend-warrior ufologists with hand-painted signs of salvation turned skyward, these blind believers await the day when Sigourney Weaver's great *Avatar* pocket sequencer will come, rendering the shapes and sizes and contours and contexts of things ultimately subordinate to the order of their nucleotides. I too await that day — partly because it sounds a lot less expensive than \$10 per forward and reverse read per locus — but I will continue to consider molecular tools and techniques to be precisely that: tools and techniques. Criminology did not stop sketching subjects, taking fingerprints, performing behavioral analyses and building psychological profiles with the advent of DNA sequencing. Forensic science did not wither and die in the shadow of the pipette and thermocycler. On the total and absolute contrary. One came about to enrich, not replace, the other. Why is this not happening in the entire wide-open field of fungal systematics? By what logic can the freight train of mycology disconnect cars from the caboose forward and expect to carry the same amount of cargo? I have no answer.

In practical terms, I am left to ponder, then, what will become of *Entolomataceae* without Tim Baroni, whose position his

university specifically did not wish to renew with a new hire despite him finding and personally recommending a replacement mycologist. His multicontinental collections are now in the process of a great diasporic relocation effort. What will become of *Amanitaceae* without Rod Tulloss, who has funded his own studies and the training of students/assistants directly out of his engineering pension, hoping to give someone the unenviable job of trying to live up to his towering reputation after he's gone? What will become of boletology without Roy Halling, lepiotology without Else Vellinga, or marasmioids, mycenoids, reduced agarics and the untold hordes of little, white-spored, saprotrophic tropical curiosities after Denins Desjardin? Can polyporology survive without Leif Ryvarden? Will anyone be able reliably to discern from one another any of the literal dozens of nectrioid genera without Amy Rossman or Priscila Chaverri to consult? What has become of the study of jelly fungi since the death of Bernard Lowy (answer: almost nothing!)?

Before anyone dreams of placing the blame for the absence of heirs to these alphataxonomic thrones on the shoulders of the outgoing monarchs, ask them how many graduate students they've had, or how many were feasible to take on the more their universities demanded of them, or the more the money dried up, or the thinner the incentives or job prospects became for young people contemplating a 2- to 6-year degree in fungal taxonomy. Ask them how many grants they didn't get even after dutifully reapplying and abiding by reviewer commentary, or how many of them got tenure to study fungi. Chastising our giants for there being no one to inherit their legacies is like blaming a woman from Chernobyl for being unable to bear children. There are real reasons for the disappearance of mycological alphataxonomy, and they are resoundingly NOT the failings of the outgoing alphataxonomists. The reasons are systemic.

I can think of a few people whose lives I am grateful for (and whose deaths I prefer not to think about), which helps to alleviate some of this anxiety by offsetting some of our past and pending losses: Björn Wergen, Roo Vandegrift, Brian Perry, Luis Quijada, *lots* of bright young people in Latin America, people I'm forgetting but whose absence on this list is no indication whatsoever of their not deserving to be here. There are also very, very bright parataxonomists out in the world growing big and strong on a diet of digital literature, discussion fora, and more time out in the field and hunched over the microscope than anyone in academia has been allowed to do for the last half century. But we will be inheriting a different world than the one inhabited by our predecessors, a world in which, if recent history is any indication, there will be less and less science funding to go around by the year, and of what remains, only that which is considered "transformative" by the many-faced funding gods will be given the time of day.

"Transformative" is the National Science Foundation's new one-word criterion for research to be meritorious of public funding. Taxonomy is largely not considered to be "transformative" enough to meet the bar, and so it is increasingly left out in the cold. When taxonomy forms a part of a grant it is basically hitchhiking, brought aboard out of what often feels like pity. Perhaps the dumbest part of this new dressage course for scientists is the apparent failure on the part of the NSF — to say nothing of other funding bodies which follow the NSF's lead — to appreciate what transforming *is*. Transformative science, by definition, calls upon untransformed, naturally occurring, preexisting *things*, in order that our understanding of these *things* may be *transformed*. Taxonomy, and exploratory fields like it, *are the providers of these things*, the *prima materia*, for any transformations that are to follow. We make possible the first variable on the left side of the equals sign in the transformative science equation of multiplying, dividing, subtracting and adding *things* to get *new results*. The discovery, manufacture and distribution of penicillin necessarily required not just information on how *Penicillium* works, but the knowledge that *Penicillium is a thing in the first place*. Sometimes the fundamentalness of a thing can make it almost invisible, taken for granted, while its absence would be instantly and universally felt. Take a look at old episodes of the *Pyramid* or *Password* game shows and watch the brains of full-grown, educated, human adults turn to momentary mush when tasked with making their teammates recite a word that they themselves cannot utter aloud. Imagine a pre-Internet city with no phone books, or as Roo Vandegrift envisions in the cover illustration, all the goods in a supermarket with no aisles or labels. Restricting science funding only to those who are pursuing or can promise transformativeness in their research is akin to rewarding hips for being taller than feet.

I have no great proclamations or predictions for what to do with this world the more that we careen toward it. In all honesty, I experience double as much existential dread as joy in this field with my small place in it. It will never pay my bills or those of my fellow (para)taxonomists without great compromise, the objects of our curiosity are in as much trouble as most living things on Earth, and natural history writ large is being relegated to museums that are being literally set on fire by governmental contempt**.

It will be a curious thing if we who truly, carefully study living things out in the world go extinct before our subjects do. I always pictured taxonomy riding a final crescendo as life and habitats started to sundown out of existence, but it's sadder, and perhaps more realistic, to imagine a near future in which we vanish first, unnoticed except by each other, as human civilization moves further and further away from the sort of conditions that produced a love of nature for its own sake, and more toward the constant panic and fever of survivalism, of last-minute solution-seeking. The irony is how crucial the quaint, antiquarian, naphthalene-

scented taxonomist could be to those species- and society-saving solutions, and how inherently — and regrettably — human of us it will be not to have realized that until it's too late.

[*: *'parataxonomy' is defined by Wikipedia as "the use of less qualified assistance to taxonomists in the practice and science of classification."*]

[**: see <https://www.mintpressnews.com/the-price-of-austerity-rio-museum-destroyed-by-fire-dry-hydrants/248749/>]

Danny Newman is a parataxonomist and photographer primarily interested in the systematics of Andean-Amazonian fungi. He has provided research assistance to graduate students of San Francisco State University, SUNY College of Environmental Science and Forestry, and Oregon State University, and has presented at workshops, academic conferences and mycological societies throughout the western hemisphere. Newman is currently a curatorial intern at the Cornell Plant Pathology Herbarium in Ithaca, New York. His photographs can be found at myxomop.smugmug.com and on Instagram (@kallapmpero), with detailed observations at MushroomObserver.org.

Invitation to Join the Continental Mycoblitz 2019

Explore, Discover and Contribute to Fungal Biodiversity Knowledge

By: Stephen Russell

A first-of-its-kind event will take place the week of August 12-19th – a North American continent-wide online mycoblitz. You may have heard of a “bioblitz” – an intense and usually time-limited survey of all the organisms living in a given geographic area. A mycoblitz is a similar survey, with the focus solely on fungi. An innovation of this mycoblitz will be that it will be coordinated online. Individuals anywhere in North America, from the Atlantic to the Pacific, from Canada and Maritimes to Mexico, will be documenting the biodiversity of fungi in their local area and submitting select specimens for DNA analysis.

The process to participate is easy and anyone who is willing to make scientifically valuable collections of mushrooms can join in. Begin by taking geotagged color photographs of an interesting mushroom, document some basic field notes on a numbered [field data slip](#), upload your images to the [iNaturalist project created for this event](#) and submit the dried specimen to our processing center.

You can participate on your own time schedule and from your favorite local hunting grounds over the course of the week of the event. Mark your calendars to collect fungi in your area and be a key player in the first-ever continental-scale online mycoblitz. You will have the ability to make a personal contribution to our understanding of the biodiversity of North American fungi by submitting data and dried collections to this project.

How to Participate

The North American Mycoflora Project (www.mycoflora.org) has the goal of documenting all species of macro (visible) fungi across North America. More collections of more novel species are needed to make substantial progress toward the goal. The National Geographic Society is funding the [Continental Mycoblitz 2019](#) in order to expedite the rate of species discovery. More than 2,000 fungal specimens already have their DNA sequenced and housed in herbaria. All NAMA members and members of the general public, whether currently involved in a Mycoflora Project or not, can contribute ten of the most interesting specimens they find during the course of the event.

What Mushrooms Are We Looking For?

The short answer is anything “interesting” or “unusual.” Possibilities may include species that are locally uncommon or rare, species with odd morphology, or observations where a genus or species name cannot be applied from photographs alone. Our skilled foray identifiers will make the final determination on the most interesting 2,000 collections from the pool of specimens that are sent in.

DNA sequencing will be focused toward specific taxa during this event: *Cortinarius*, *Inocybe*, *Amanita sect. Vaginatae*, and the *Marasmiaceae*. We estimate that 20-30% of the total number of specimens selected for sequencing will come from these groups, as they have many unknown and undescribed species. Please help us better understand these taxa by including a few specimens in your submission.

Benefits of an Online Mushroom Foray

The Hoosier Mushroom Society (Indiana) began work on a DNA-based biodiversity survey in 2015, with the goal of having a “reasonably comprehensive” survey of all the macrofungi that exist within the state – and to accomplish this goal within a 10-year timeframe. The limiting factors for making substantive progress towards the goal soon became clear; both the number of recently vouchered specimens available and the rate which new vouchers were being retained was too low. Traditional mushroom forays were never going to bring in enough specimens

from a large enough geographic region. A new model for broadly engaging club members and for conducting biodiversity research was required.

Starting in the fall of 2017, the organization began holding “online forays” – week-long collecting events that allowed any individual to photograph and collect mushrooms, upload the metadata online, and to submit the specimens for DNA sequencing. The first event surpassed the goals of the organizers, garnering over 1,300 observations of macrofungi from across the state during the week of the event. Most importantly, over 800 of those observations were associated with dried physical specimens that were sent to Purdue University’s Kriebel Fungarium. Over 500 of these specimens were ultimately retained in the fungarium and their DNA was sequenced.

The benefits of this type of event for the Mycoflora Project were clear: it reduced or even eliminated the costs of attending a foray for the average participant, as individuals did not have to travel to a single physical location at a specific time to make a meaningful contribution. Distributing the collecting efforts broadly across the entire state allowed more prime terrain to be covered – areas with local environmental conditions that brought out more mushrooms – meaning a higher diversity of species was recorded. Finally, the low barriers to entry for the event started many new people down the path of regularly drying collections of interesting mushrooms they were already photographing. Ultimately, these events drove an increase in the amount of biodiversity being documented across the state of Indiana. The continental mycoblitiz can do the same for the continent of North America.

Join the Project!

If you are interested in participating, we ask that you take a few minutes to [register for the event](#), complete the brief training modules and join the [project on iNaturalist](#). During the foray week, you can help us to identify observations that are uploaded from your own locality, submit your own dried collections or just follow the interesting specimens that are encountered. It will be a fun week of collecting for all involved!

We hope to see your name among the leading contributors to the event!

Call for nominations for Boreal Regional Trustee

The Boreal region, currently encompasses two Canadian provinces, Alberta and Newfoundland and Labrador needs a Regional Trustee. Regional trustees serve 3-year terms and have the following responsibilities:

The Regional Trustee acts as the liaison between NAMA and the mycological clubs (both affiliated and unaffiliated) in his or her region. The responsibilities of the Regional Trustees - within their regions - are:

1. to promote the growth and development of NAMA
2. to work with the affiliated clubs as follows:
 - a. arrange to have club events posted on the NAMA Website.
 - b. send NAMA information to the clubs for publication in their newsletters, websites and message boards.
 - c. request clubs to place a link to the NAMA website on their websites and message boards.
 - d. encourage clubs to have their members join NAMA and add NAMA membership applications to their membership drives.
 - e. work with the NAMA Membership Secretary to collect the NAMA club dues in a timely manner.
3. to identify and contact each non-affiliated mycological club and encourage it and its members to join NAMA, and provide any necessary assistance and/or paperwork.
4. to submit an annual report to the Board of Trustees.

Please contact First Vice-President Salma St. John (vicepresident1@namyco.org) if you wish to volunteer or to nominate someone.

Fungal Food as Fungal Art

Howard Goltz

This article is in concert with the mission of NAMA's newly formed ad hoc Mushroom Culinary Arts Committee, which was formed to recognize and celebrate artistic and skillful ways of preparing, storing, cleaning, preserving and creatively presenting fungal foods. (Contact Salma St. John, Committee Chair with your interest: salmastjohn@charter.net)

Most, if not all, NAMA members like to eat mushrooms: flavorful, aromatic, nutritious, wild and organic. Anthony Michael Blowers takes all that sensory luxury a step further and makes mycophagy beautiful. Can you say “art?” He is a self-taught photographer and wild-food fanatic – especially when it comes to featuring mushrooms in the recipes.

I've been following Anthony's Facebook postings and continue to be amazed by his creativity in combining foraged edibles into beautiful gastronomic delights. Following is a visual sampling of his recipes and presentations. You are invited to join his 24,000+ member Facebook Group: “I Love Wild Mushrooms!” or his personal Anthony Michael Blowers Facebook page to view more of his artistry with fungal foods, beverages, soups, salads, appetizers, mains and desserts! **Be inspired! It's summer, keep looking and get cooking!**



Anthony Michael Blowers, photographer and mycophile from South Haven, Michigan, ‘capturing’ *Trametes lactinea* at Fort Cooper State Park, Florida

Anthony says: “Get lost in the forest and you will find yourself. I've been into mushrooms as long as I can remember and I'm very passionate about what I do with them. It brings me great joy. I'm self-taught, have no formal training other than working at a Mexican restaurant years ago. I'm just winging it most of the time and try to keep things as natural and simple as possible.”



“Chanterelle-apricot Cocktail”

Chanterelle-infused vodka, apricot nectar, chant syrup, a splash of club soda, apricot slice and candied red chanterelle for the garnish.



“Chanterelle-infused Vodka”



“Morels and Ramps 3 Ways”

- 1) Stuffed morels with goat cheese (and some cream to make it smooth), lump crab, minced ramps, wild mustard, smoked paprika, sea salt and lemon juice. Roll the stuffed bundles of joy in flour, dip into egg wash, then bread crumbs. Use vegetable oil for frying.
- 2) The bisque is made with heavy cream, freshly picked morels, lump crab, chicken stock, caramelized ramp bulbs, ground wild mustard, pink Himalayan salt, thyme, smoked paprika, lemon zest and a splash of cooking sherry.
- 3) A “yard salad” made with dandelion greens, chickweed, wood sorrel, wild violets, and a morel-ramp vinaigrette.



“Today’s Hike Pickled in a Jar

Pheasant’s back mushroom (*Cerioporus (Polyporus) squamosus*), ramps (*Allium tricoccum*), ostrich fern (*Matteuccia struthiopteris*), hairy bittercress (*Cardamine hirsuta*), and purple/white violets. The brine is made with rice wine vinegar, apple cider vinegar, pink Himalayan salt, green peppercorn, ground wild mustard seed, agave nectar, and California bay leaf. The pheasant back mushroom and ferns were simmered in the brine prior to canning – and used later in spring rolls.



Pino Grigio-Poached *Hericium* with Hollandaise Sauce



“Spring Rolls with Pickled Pheasants Back”



“Chicken of the Woods Quesadillas” made with huitlacoche (*Ustilago maydis*) corn tortillas



“Wild Alligator with Black Trumpets” with white rice, green onion, cilantro and lime, rolled in a banana leaf and steamed.



“Skillet-Seared Venison Tenderloin”
with roasted baby potatoes, steamed morels,
broccoli, goat cheese and a wild grape/port
reduction



“Steamed Sunfish” with milkweed pods, pickled *Clavulinopsis fusiformis* and oyster mushrooms



“Candy Cap Snow” is inspired by Woodland Keep. Freshly fallen snow drizzled with candy cap mushroom syrup, garnished with pomegranate seeds and spruce tips.



“Candy Cap Crepes with Chanterelle Apricot Marmalade and Mayapple Mascarpone”

Second in a series: NAMA President Barbara Ching invited me prepare periodic articles for the Mycophile on the subject of “Fungal Art.” The intent is to tell the stories of contemporary artists and the wide range of their mushroom-centric work, be it photography, painting, illustration, writing, 3D creations, writings, or even the art of cooking! This series is adjunct to NAMA’s “Art Registry,” which is a listing of historic-to-early-2000s mushroom artwork. As art is in the eye of the beholder; I invite you to contact me with what you consider “mushroom art ” ideas for future articles. Howard Goltz, Recording Secretary, NAMA: Goltz.Howard@gmail.com

Mycorrhizae Explained

By David Rust

The first single-celled fungi appeared on planet Earth nearly a billion years ago. By the time plants colonized land in the Silurian (443 to 416 million years ago) and Devonian periods (419 to 359 million years ago), fungi in the phylum Mucoromycota had developed an arbuscule, a tree-like structure capable of colonizing plant cells and exchanging nutrients. This evolutionary step resulted in the first plant-fungal symbiosis, known as arbuscular mycorrhiza. Arbuscules can be found in fossils from 450 million years ago; these ancient structures are very, very similar to arbuscules we see today.

Mycorrhizae are present in 92% of plant families (80% of plant species). Plants allow, and indeed require, mycorrhizal fungi to colonize their roots. In this symbiotic relationship, fungal hyphae greatly expand the ability of plants to obtain nutrients and water. Fungi break down organic matter and weather mineral surfaces and, in so doing, collect essential nutrients such as nitrogen, phosphorus, potassium and nearly a dozen other minerals.

The majority of vascular plants are mycorrhizal: 72% are arbuscular mycorrhizal (AM), 2.0% are ectomycorrhizal (ECM), 1.5% are ericoid mycorrhizal and 10% are orchid mycorrhizal. Just 8% are completely nonmycorrhizal (NM), whereas 7% have inconsistent NM-AM associations. Most NM and NM-AM plants are nutritional specialists (e.g. carnivores and parasites) or habitat specialists (e.g. hydrophytes and epiphytes) (Brundett, 2018).

Let’s look at three major types of mycorrhizal relationships: Ectomycorrhizal, Arbuscular (often formally referred to as Vesicular-Arbuscular) and Ericoid. There are structural and functional differences between these types, including how they colonize roots, the resources they provide and the types of plants with which they partner. (See Chart Below)

Ectomycorrhizae: Ectomycorrhizae (ECM) are generally host specific, having evolved over the past 200 million years with their plant associates. Most ECM fungi are basidiomycetes, forming fleshy fungal bodies. In this mycorrhizal type, hyphae cover the root tip with a mantle structure and then form a Hartig net, which penetrates into the space between the root’s cortical cells. Smith and Read describe the Hartig net as a labyrinthine inward growth of hyphae between the epidermal and cortical cells. As the colonized root hairs grow and harden, the association becomes untenable in 2 to 5 years’ time. Hyphae constantly need to renew connections on new root growth.

ECM associations are generally with pines and hardwoods (gymnosperms and angiosperms). Even though they only represent 2% of mycorrhizae, ECM fungi colonize commercially valuable trees and produce edible fungi, vastly expanding their importance to humans. In the northern temperate regions, plants such as pine (*Pinus*), spruce (*Picea*), fir (*Abies*), poplar (*Populus*), willow (*Salix*), beech (*Fagus*), birch (*Betula*) and oak (*Quercus*) typify the ECM association. In total, 140 genera in 43 plant families have been identified as forming ECM.

Ectendo- and Arbutoid Mycorrhizae: Two additional types of mycorrhizae (plus five more minor variations) should be noted, having characteristics of ectomycorrhizae with a high degree of intracellular penetration.

Ectendomycorrhiza: occurs primarily on *Pinus* and *Larix* and is distinguished by the fact that, in addition to a usually thin fungal mantle and well-developed Hartig net of the ECM type, the epidermal and cortical cells are occupied by intracellular hyphae (Smith and Read, 2008).

Arbutoid: found in ericaceous genera *Arbutus* (a genus of 12 accepted species of flowering plants in the family *Ericaceae*) and *Arctostaphylos* (a genus of plants comprising the manzanitas and bearberries) and genera of the ericaceous subfamily *Pyrolae*. It is distinguished

Ectomycorrhizal	Arbuscular	Ericoid
Hartig net and mantle, intracellular colonization	Arbuscules and vesicles in root cortical cells	Colonize epidermal cell, forming dense hyphal coils
Connections last 2-4 years or more	Arbuscules last 4-15 days	Hair root associations are ephemeral
Mainly provides Nitrogen and Phosphorus, and 12 other nutrients	Mainly provides Phosphorus and Nitrogen, Sulfur, Copper, Iron and Zinc	Mainly provides Nitrogen, Phosphorus and Iron
Colonizes 2 Gymnosperm lineages and 28 Angiosperm lineages	Colonizes vascular plants, mainly found in grasslands	Colonizes dense fibrous roots of ericaceous plants
Basidiomycetes and some Ascomycetes	Glomeromycota	Ascomycetes and some Basidiomycetes
Long branching hyphae	Thin hyphae	Short hyphae
Temperate, boreal, Mediterranean, and some tropical forests	Tropical and temperate forests, grasslands, agricultural crops	Heathlands, tundra, boreal and temperate forest understory

from the ectendomycorrhizal category by the restriction of intracellular penetration to the epidermal layers of the root and by the involvement of a distinct suite of largely basidiomycetous fungi more often found as ECM symbionts of trees (Smith and Read, 2008).

Arbuscular Mycorrhizae: Fossil evidence from the Devonian Period reveals a structure that looks exactly like modern AM fungi. Although the current theory is that plants and fungi arrived on land about the same time, Dr. Joey Spatafora postulates that arbuscular fungal bodies may have preceded plants. AM is thought to have a monophyletic origin in the Ordovician Period, approximately 480 million years ago (Redecker et al., 2000; Delaux, 2017), and is found in the majority of land plants occupying virtually all ecological niches (Read, 2002; Wang and Qiu, 2006).

AM fungi are characterized by the formation of unique structures—arbuscules and vesicles—by fungi of the phylum Glomeromycota. AM fungi help plants to capture nutrients such as phosphorus, sulfur, nitrogen and micronutrients from the soil. AM fungi deliver about 90% of the phosphorus and 50% of the nitrogen needed by the host plant.

Arbuscules are short-lived structures (4 to 15 days), which provide nutrient transfer. Phosphorus is actively transferred to the plant throughout the life of the arbuscule. One reason for the short life of arbuscules could be that because their host plants grow so quickly, fungi constantly need to recolonize new roots.

After the first arbuscules degrade, structures called vesicles often form within the colonized root. Vesicles, the second characteristic structure of AM mycorrhizae, are thick-walled structures. Vesicles contain large amounts of lipids and often numerous nuclei. In dead root fragments, vesicles can act as propagules and regrow hyphae to colonize new roots (Smith and Read 1997). The hyphal network is relatively long-lived and is able to colonize new roots as they enter its domain.

No convincing evidence has been presented to suggest that AM associations are specific. Lack of specificity is indicated by the fact that, globally, only around 300 to 1,600 AM fungal taxa associate with about 200,000 plant species. In fact, in nature, plant roots are usually simultaneously colonized by multiple AM, which colonize several plant individuals at the same time, often from different species (Walder, 2015). AM fungi colonize not only grasslands and cultivated agricultural plants but also trees such as maples, cedar, redwood and sequoia.

Ericoid Mycorrhizae: Ericaceous plants are generally found in the understory of a forest. They can also be found in alpine ecosystems and bogs in nutrient poor soils. We know ericaceous plants along the West Coast as huckleberry, manzanita, madrone and native rhododendron. In northern states, they're represented by cranberries and blueberries. On the East Coast, ericaceous plants include magnolia and catalpa.

Plants in *Ericaceae* have dense fibrous roots terminating in a structure called “hair roots.” Because hair roots are delicate structures, these mycorrhizal associations are relatively short-lived. Ericoid mycorrhizae (ERM) are characterized by the formation of intracellular hyphal coils in the epidermis of hair roots and hyphae extended up to 1 cm from the root surface (Read, 1984). ERM typically lack multilayered hyphal mantles.

Author's note: the next installment of this series will include more on how mycorrhizal connections work, the evolution of mycorrhizal fungi and their partnerships with soil bacteria.

A Helpful Glossary Reference

arbuscule – a highly branched (“little tree”) structure that grows inside a plant's cell wall but outside the plant's plasma membrane.

ascomycete – a fungus having spores that develop within asci. The ascomycetes include the fungal component of most lichens as well as a few large forms such as morels and truffles. Ascomycota is the largest phylum of the kingdom Fungi, with over 64,000 species.

basidiomycete – a fungus having spores that develop on a basidium; a group of higher fungi that have septate hyphae, including rusts, smuts, capped mushrooms and puffballs.

epiphyte – a plant that grows above the ground, supported nonparasitically by another plant or object and deriving its nutrients and water from the air.

ericoid – resembling heath. The *Ericaceae* are a family of flowering plants, commonly known as the heath or heather family, found most commonly in acid and infertile growing conditions.

Hartig net – a network of inward-growing hyphae that extends into a plant's root, penetrating between the epidermis and cortex. The Hartig net is named after Theodor Hartig, a 19th-century German forest biologist and botanist.

hypha – (**hyphae** is plural) a long, branching filamentous structure of a fungus. In most fungi, hyphae are the main mode of vegetative growth and are collectively called “mycelium.”

hydrophyte – a plant that grows in water or very moist substrate; an aquatic plant.

monophyletic – a group of organisms descended from a common evolutionary ancestor.

mycorrhiza (**mycorrhizae** is plural) - a symbiotic association between a fungus and a plant. The term ‘**mycorrhizal**’ refers to the role of the fungus in a plant's root system.

rhizosphere – a plant's root system and the narrow region of soil that is directly influenced by root secretions.

vesicle – a structure within or outside a cell, consisting of liquid or cytoplasm enclosed by a lipid bilayer.

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