The Potomac Sporophore

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In This Issue:

Chocolate: A Tasty Byproduct of Fungal Activity

Thomas Roehl
Newsletter Editor

It seems like there has not been any rain this fall. The hens of the woods came up quickly but were stunted by the lack of moisture. Most other fall mushrooms appear to be waiting for better conditions. What can you do if you are craving mushrooms during this drought? Perhaps you can eat some chocolate. Although chocolate does not resemble a mushroom in the slightest, chocolate production is completely dependent on fungi. The fungi *Glomeromycota* spp, *Candida krusei*, and *Geotrichum* sp. are all essential to the production of chocolate.

The Cacao Tree

Chocolate comes from the seeds of the cacao tree, *Theobroma cacao*. In Ancient Greek, *theo* means "god" and *brosi* means "food." *Theobroma*, therefore, translates as "food of the gods."

The cacao tree is a tropical understory tree native to the rainforests of Central and South America. It has since been cultivated and planted in tropical regions across the globe and is primarily grown for export of its seeds. The seeds are produced in very large, heavy pods that grow directly on the tree's larger branches.

The cacao tree is endomycorrhizal, so its roots contain mutualistic fungi that provide it with essential nutrients in exchange for sugars. In these mycorrhize, fungi from the phylum *Glomeromycota* penetrate the root cells of the tree and form specialized structures that facilitate nutrient exchange.

Public Domain

Theobroma cacao produces large seed pods directly on its trunk.

Fungi take a much more active role later on in chocolate production, but for now it is all up to the cacao tree. Once the tree is big enough, it starts to flower and produce seed pods. The flowers are Continued on Page 2

Hiker's Notebook: The Elegant Stinkhorn, *Mutinus elegans*

William Needham

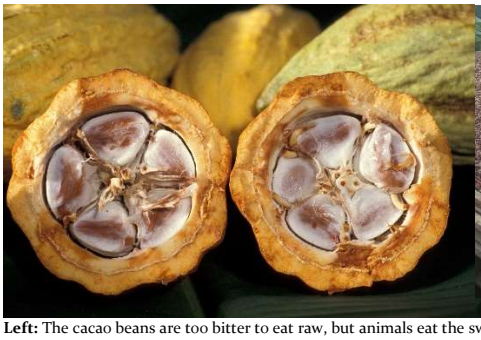
The Elegant Stinkhorn, *Mutinus elegans*, attracts flies with its foul odors. In this way, it coopts the flies into spreading its spores.

William Needham
First Vice President

Common Name: Elegant Stinkhorn, Devil's Dipstick, Devil's Horn, Devil's Stinkpot, Dog Penis - The fetid smell of the fungus coupled with its cornucopian shape is appropriately used for the common name stinkhorn. The more pejorative names are based on its phallic appearance. Elegant may be in reference to its unadorned, almost artistic simplicity, however suggestive.

Scientific Name: *Mutinus elegans* - The generic name is derived from an early Roman god of fertility, Mutinus Titinus, whose beneficence was sought by women to facilitate the conception of a child. Mutinus was originally thought to have been the focus of a phallic worship cult in early Rome and was related to the Greek god Priapus (the adjective priapic means using the phallus in a symbolic manner). Priapus was one of the regional names for the god Pan, the protector of the flocks who was also deemed responsible for the fecundity of the ewes, thus establishing the phallic association. The use of the god of fertility as the name of the genus is an obvious reference to the phallic Continued on Page 7

Food



Left: The cacao beans are too bitter to eat raw, but animals eat the sweet white seed coat. *Photo: Public Domain* **Center:** Fermented cacao beans spread out in the sun to dry. *Photo: pipeafcr (CC BY-SA 3.0)* **Right:** This machine, called a melanger, mixes together cocoa butter, coca liquor, and other ingredients used to make chocolate. *Photo: Sanjay Acharya (CC BY-SA 3.0)*

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positioned flush with the trunk and on larger branches, which allows the tree to support the large cacao pods. As the pods ripen, farmers gently cut the pods off the tree and remove the seeds from the pods. Each pod contains 20-50 seeds, which are often called "beans" after being harvested.

In their raw form, cacao seeds are impossible to eat! They are much too bitter to be eaten by animals or humans. The seed coat, however, is pulpy and sweet. Animals will eat the seed coat and discard the bitter seeds. The cacao tree benefits from this behavior because the seeds are spread throughout the nearby forest. This increases the chances that a seed will successfully germinate and grow into a new tree.

Bean Fermentation

Humans, however, discovered that rotten cacao seeds actually tasted good. It turns out that fungi are the organisms responsible for transforming inedible cacao seeds into the beginnings of the world's favorite delicacy. The yeast *Candida krusei* and a yeast-like *Geotrichum* sp. are the two fungi that ferment cacao beans. These fungi are present in the environment, but companies often add specific strains that result in a particular flavor.

To begin the fermentation process, the beans are first removed from their pods and piled into boxes. The fungi are added and the piles of beans are allowed to ferment for a few days. During this time, the beans are stirred to ensure that fermentation takes place evenly. The fungi ferment the sugars in the pulp, releasing ethanol and heat. Bacteria then break down the ethanol into lactic acid and acetic acid, also releasing heat. The heat and acetic acid kill the seeds by the second day.

As the beans die, their cell walls break down and the cellular contents undergo a variety of complex chemical reactions. These reactions produce the chemicals responsible for chocolate's distinctive flavor and aroma. Holes in the bottom of the fermentation boxes allow the extra acids and pulp to drain off, leaving the now-desirable beans. After the fermentation process is completed, the beans are dried and shipped to manufacturers.

Manufacturing Chocolate

The rest of the chocolate-making process is up to the chocolate manufacturer, but they all follow the same basic process.

Upon receiving the beans, manufacturers roast them to bring out the flavor of the chocolate. The outer shell of the bean becomes quite brittle during roasting. After roasting, the shell is removed and the meat from the inside (in pieces called "nibs") is sorted by size.

The nibs are then ground into a liquid known as "cocoa liquor." Next, the cocoa liquor is pressed to separate out its solid and liquid components. The fat-based liquid is called "cocoa butter" while the remaining solids are known as "cocoa presscake." The cocoa presscake is ground to make cocoa powder. Cocoa butter is used in soaps, cosmetics, and medicinal preparations while cocoa powder is used to flavor foods and beverages.

In order to make chocolate, cocoa

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Honey Mushroom Jerky

Ingredients

- 4-5 lbs. honey mushrooms
- 1/2 cup soy sauce
- 1/2 cup cider vinegar
- 2-3 T brown sugar or maple syrup
- 1 T garlic powder
- 1 T sriracha
- 1 T smoked paprika

Thomas Roehl

Directions

1. Clean mushrooms. Whether you use the stalks is up to you; they're very fibrous, resulting in an extra-tough jerky.
2. Boil mushrooms in water for 15 minutes. Meanwhile, mix all other ingredients for the marinade.
3. Drain caps and add to marinade; let sit for at least 6 hours.
4. Dry on a dehydrator, or in on oven set on low with the door propped slightly open. Timing will vary by dehydrator; mine takes about 6-8 hours.

Recipe contributed by Elizabeth Hargrave, MAW Secretary

Thomas Roehl

Bruce Boyer (far right) walks a small group of MAW members through the process of identifying a mushroom during the August MAW meeting.

Meeting Files

August 2: Identification Workshop

Thomas Roehl
Newsletter Editor

The August 2 meeting was an informal format that allowed members to try their hand at mushroom identification. Thanks to the warm weather, the meeting began outdoors but moved inside as the sun began to set.

After a short introduction, attendees broke into small groups to work on their identification skills. Each group had an experienced identifier who helped them use a field guide and work through the identification process. Those who attended the identification workshop became more familiar with the general groups of mushrooms, the features to examine when identifying a mushroom, and the process of using a field guide.

People brought in lots of mushrooms for identification, including large amanitas, colorful russulas, small coral fungi, one Lobster Mushroom, lots of polypores, a few boletes, and some chanterelles.

MAW's September meeting was cancelled and members were instead encouraged to attend the Mushroom Tasting and the North American Mycological Association (NAMA) Shenandoah Foray.

October 4: Ryan Kepler's Overview of Fungal Insect Interactions

Thomas Roehl
Newsletter Editor

MAW's monthly meeting on October 4 featured Ryan Kepler, who quickly introduced fungal parasites of insects. Ryan works at the Systemic Mycology and Microbiology Laboratory at the United States Department of Agriculture, where he studies fungal pathogens of insects.

Ryan's talk, which he also presented during the NAMA foray in September, gave an overview of the major lineages of insect-related fungi with an emphasis on insect pathogenic fungi commonly found in eastern North America.

Most of Ryan's work has focused on fungal diseases of insects, which have a remarkable degree of diversity. Insect pathogens are present in every major lineage of fungi, though are mostly absent from the Basidiomycota.

In fact, one of the most ancient lineages of fungi, the Microsporidia, are obligate pathogens of animals and many are found in insects. These unusual organisms are so reliant on their pathogenic lifestyle that they lack mitochondria. Despite this, they are only weak pathogens and rarely have a significant impact on their host. Ryan pointed out two significant exceptions, both of which infect insects: *Nosema apis*, which has been implicated in Colony Collapse Disorder of honeybees,

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MAW Board of Directors

Chocolate (Cont'd)

Continued from Page 2

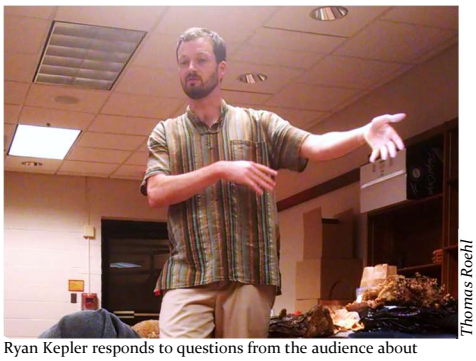
butter is added to cocoa liquor along with sugar, milk, and other ingredients. The exact recipe varies depending on the type of chocolate. Once mixed, the chocolate is pressed through a series of rollers to refine its texture.

This is followed by a process called "conching," in which the chocolate is mixed and aerated at a high temperature. Conching ensures that the chocolate is evenly blended and helps remove some of its natural acidity. The chocolate is then heated, cooled, and reheated to prevent crystallization. Finally, the chocolate is poured into molds, packaged, and distributed and sold around the world.

Public Domain

Various forms of processed and molded chocolate.

Meetings



Thomas Roehl

Ryan Kepler responds to questions from the audience about insect fungal interactions at the end of the October meeting.

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and *Nosema locusti*, which has been used as a pest control for locusts.

Ryan then switched to a discussion of the Entomophthoromycota, a relatively new phylum of strong insect parasites. These fungi kill and devour their hosts and usually produce fruiting structures that can be seen with the unaided eye. Some of these pathogens, such as *Furia ithacensis*, are such strong pathogens that they produce "epizootic events," where hundreds of infected insects die at the same time.

An economically important fungus in this phylum is *Entomophaga maimaiga*, which kills gypsy moths. After a couple of failed attempts at introducing *E. maimaiga* to control the gypsy moth population, the fungus finally started attacking the invasive moths in the mid-1980's. Today, *E. maimaiga* shadows the spread of gypsy moths and provides an effective control on their population.

The group of entomopathogenic fungi that Ryan has studied the most is the order Hypocreales. This order is in the phylum Ascomycota and can produce identifiable mushrooms like *Cordyceps militaris*. Fungi in this group have a wide range of hosts. They can infect insects and arthropods in 17 different orders, a variety of plants, and even other fungi!

Fungi in the Hypocreales share a common generalized life cycle. When a spore lands on its host, it penetrates the outer layer by using destructive enzymes and physical pressure from a structure called an appressorium. The fungus then infects and kills its host. After consuming as many resources as it can, the fungus begins producing spores. If two sexually compatible spores landed on and infected the same insect, they will mate and produce ascospores. Otherwise, the fungus will produce conidia. Different types of spores are produced on structures with different morphologies. Sometimes, the fungus produces both sexual and asexual fruiting bodies, which indicates that it is making both types of spores. These spores are then released to infect more hosts.

Hypocreeales species produce ascospores in structures called *perithecia*. Perithecia are flask-shaped structures that look like tiny bumps on the surface of the fruiting body. Hypocreales contains three taxonomic families: Cordycipitaceae, Ophiocordycipitaceae, and Clavicipitaceae.

The Cordycipitaceae generally produce mushrooms that are pale to yellow or bright orange to red. The stipe in these mushrooms is fleshy in texture and can easily be squished between two fingers. They are usually found in leaf litter and shallow soil.

Probably the most widely known genus in the Cordycipitaceae is *Cordyceps*, which can infect any insect, though Ryan usually finds them on beetles and moths.

Another genus in the family is *Torrubiella*, which infects spiders exclusively. These fungi are not as commonly collected because fewer people look for them. Ryan's advice for finding *Torrubiella* species is to try "walking along stream corridors and flipping over rhododendron leaves."

Ryan discussed one more Cordycipitaceae genus: *Akanthomyces*. These fungi infect only moths and do not produce well-defined morphological features. This makes them difficult to tell apart so specimens are often labeled "*Akanthomyces sp.*"

The family Ophiocordycipitaceae produces mushrooms with dark colors, with a hard stipe that does not give when pinched, and which fruit from deep within their substrate of soil or rotten logs. These features readily distinguish them from the Cordycipitaceae.

The most well-known member of the Ophiocordycipitaceae is the genus *Ophiocordyceps*, which includes the so-called "zombie ant fungi." These fungi infect ants, take control of their ant hosts' brains, and cause the ants to

Vote for MAW Board at Dec. Meeting

At the November meeting, the Nominating Committee proposed the following slate of people to serve on the Board of Directors for 2017:

President William Needham	**First Vice President** John Harper	**Second Vice President** Mitch Fournet
Treasurer Elizabeth Hargrave	**Secretary** Agnes Demianski	**Membership** Tom McCoy
Forays Jared Urchek	**Programs** Connie Durnan	**Newsletter** Thomas Roehl
Culinary Corinne Weible	**NAMA Trustee** Bruce Boyer	

Members present at the December meeting will be asked to vote for next year's Board. If you have any concerns or nominations, contact Elizabeth Hargrave (**secretary@mawdc.org**), the Nominating Committee Chair. If elected, the persons listed above will serve as the new Board beginning after the meeting.

climb into the forest canopy. When the ant is at the proper height, the fungus makes the ant bite onto the underside of a leaf, affixes the ant to the leaf, and finally kills the ant. The fungus then fruits and produces spores that rain down on the unsuspecting ants below. Ryan noted that *Ophiocordyceps* can be found in the eastern United States, but it is not as common as it is elsewhere.

Another genus in Ophiocordycipitaceae is *Tolypocladium*, which contains organisms that infect insects as well as fungi in the genus *Elaphomyces* (Deer Truffles). Ryan speculated that this unusual grouping happened because both the insect hosts and truffle hosts live on tree roots. This co-occurrence of species could have allowed some *Tolypocladium* species to slowly acquire the genes necessary to switch from an insect host to a fungal host. Ryan noted that the species that infect truffles do not form a lineage distinct from the entomopathogenic species. This suggests that the transition from insect to truffle was not clean and some fungi may have switched back. The process of host switching in *Tolypocladium* is probably ongoing and will not be fully settled for a long time.

Ryan wrapped up his lecture by discussing he final family in the Hypocreales: Clavicipitaceae. Fungi in this family have diverse hosts and complex morphologies. The insect pathogenic fungi are usually green or yellowish and mostly occur in East Asia. One of the most common fungi in this family is *Metarhizium*, which infects insects but is also a very common soil fungus.

Thomas Roehl

At the November meeting, John Plishke III explained the concepts he uses to take great pictures of mushrooms.

November 1: John Plischke III Introduces Mushroom Photography

Thomas Roehl
Newsletter Editor

During the November 1 meeting, John Plischke III introduced members to mushroom photography. John is an experienced mushroom photographer and is the chair of the NAMA Photography committee.

Anyone can take a picture of a mushroom, but taking great pictures requires time, attention to detail, and many re-shoots. John estimated that during the summer it takes him eight hours to go a few hundred feet. Taking professional quality photographs requires constantly adjusting the scene, the lighting, and the camera itself.

When found in nature, mushrooms are usually not photogenic. Instead of just snapping a picture of a mushroom, a good photographer arranges the scene to make it visually appealing and informative.

The first step is to arrange the mushrooms to make an interesting picture. Mushrooms are often dirty, so John cleans away as much debris as he can. This is often a delicate and time-consuming process, especially for mushrooms with sticky caps. If the mushrooms are fruiting in a cluster, you should remove any "ugly" specimens that are old, eaten, or partially rotted.

Once you have some pretty mushrooms, you need to consider arrangement. John stressed that it is important to capture all the features necessary for identification. For example, when photographing an *Amanita*, you need the cap, gills, stipe, and base in the same photo. Sometimes a button or cross-section is also useful. Getting all these things in the same picture may require some creative arranging, so consider placing one mushroom on its side.

John finds that pictures look more natural with odd numbers of mushrooms. He usually uses three or five mushrooms, since any more looks too crowded. You will probably have to move some of the mushrooms to get a tight enough grouping for a good shot. To make moved mushrooms look nice, put the largest one in the back. It may also help to dig a small hole and plant a mushroom in it or prop a mushroom up with a small stick. The goal is to make it look like the mushrooms are growing naturally.

It is also useful to add things like leaves to the scene that demonstrate the mushroom's habitat. John often breaks off small branches of nearby trees and places them around the mushroom. The fresh leaves add color and show with which type of trees the mushroom is associated. Moss is also useful for scene dressing. "I like to shoot on moss," John explained, "because it always looks so pretty."

If you are photographing tiny mushrooms, it may be impractical to rearrange them. In this case, John recommends photographing rows of mushrooms. This ensures they are all in focus and provides visual interest from one side of the frame to the other.

Mushrooms growing on wood are often harder to arrange. John recommends breaking off a few clumps of mushrooms and placing one in front of the others to create a layered effect.

Once your mushrooms are arranged properly, you have to consider lighting. Whether you are using natural light or a flash, getting the lighting exactly right requires some experimentation. When adjusting the lighting, the goal is to remove harsh shadows and illuminate all parts of the mushroom.

The most difficult part of the mushroom to photograph is the underside. This is shaded by the cap and often comes out too dark to be useful for identification. One solution to this is to carry a reflector that you can use to bounce light into shadowed areas. You can make a simple reflector by taking a piece of cardboard, folding it in half, and taping a piece of wrinkled aluminum foil to both sides. When unfolded to a V shape, the reflector will stand up on its own.

Continued on Page 6

Meetings

Continued from Page 5 This setup allows you to direct diffuse light to places you need to illuminate.

You can also improve the picture by softening harsh light sources. John often uses an umbrella or a nearby friend to block direct sunlight. The remaining indirect light illuminates mushrooms more evenly. Another option is to place a sheet of white, translucent plastic in front of the light source. This softens but does not fully eliminate shadows.

Sometimes, John explained, you can actually use bright, direct light to your advantage. You can achieve some interesting perspectives by photographing mushrooms in harsh light from different angles. As an example, John showed a picture of a chanterelle that he took from below with sunlight illuminating the cap. From that perspective, it was easy to see the network of ridges on the underside of the mushroom.

John recommended that, if you are working with a flash, you try holding the flash at different angles. Camera flashes create shadows of their own, so where you position the flash is very important. Two common places to try the flash are on top of the camera and off to the side at a 45° angle. You should try to anticipate shadows from the flash and make sure they do not interfere with shadows already there or create too many new shadows. John often tries to hide shadows from the flash behind mushrooms and other objects.

Once you have set the scene, it is time to take the picture. Thanks to digital technology, photographers can take an almost unlimited number of pictures. If your first picture did not turn out the way you wanted it to, you can adjust the scene and re-shoot.

According to John, the best way to set up a quality picture is with the mushrooms filling the entire frame. When setting up your camera to take a shot, try to get rid of as much space around the edges as possible.

One of the hardest parts of photographing mushrooms is getting the entire mushroom in focus. John recommends setting the f-stop to f-16 and focusing one third of the way back. He finds this is the best way to get the stem and entire cap in focus. If you are using a point-and-shoot camera, you should set the f-stop and ISO to their lowest possible values.

If you are not using a flash, pictures can easily come out blurry when your hands shake while shooting. Consider using a tripod and timer to reduce blurriness due to camera shake.

John reminded the audience that the perfect shot is often at a slightly different angle. If your picture did not look exactly right, try getting a different perspective by moving the camera to another location.

John ended his talk with a slideshow of the winning pictures from the 2016 NAMA photo contest. He explained that the photo contest has three categories: documentary, pictorial, and judge's option. Documentary photos are ones that you would expect to find in a field guide. Their primary purpose is to show as many of the mushroom's morphological features as possible. Pictorial photos should show mushrooms as they appear in nature. For this category, features are less important than aesthetic quality. The judge's option category comprises all other kinds of fungus-related pictures. The winners in each category receive a prize from NAMA. Additionally, photos entered in the contest are often used in field guides.

To submit photos for the 2017 NAMA photo contest, visit the NAMA website at **www.namyco.org** or send an email to John at **fungi01@aol.com**. Entrants should provide the name and location (if known) for each mushroom as well as their name and a picture of themselves.

Upcoming Events:

Consult the "Upcoming Events" section on **http://mawdc.org** for the most current schedule of events and to keep up with any changes.

Dec. 6 – Monthly Meeting: For our club's December meeting, please welcome Dr. Denis Benjamin, a well-rounded mycologist who is best known for publishing a book about mushroom toxicity *Mushrooms: Poisons and Panaceas* two decades ago. His talk for the December meet will focus on the same subject matter.

Jan. 2017 – No Meeting.

Feb. 7 – Monthly Meeting: Social meeting with time for administrative and event planning for 2017.

Mar. 7 – Monthly Meeting

Apr. 4 – Monthly Meeting

Get Ready for These Spring Events:

Morel Forays – April 15-16, 22-23, 29-30, May 9-10

May 20 or 27 – MAW Wild Foods Tasting: spring culinary meeting

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

Stinkhorns (Cont'd)

Continued from Page 1

shape of the stinkhorn fungus. *Elegans* is Latin for elegant. Stinkhorns are in the family *Phallaceae*, which is also derived from the priapic root phallus.

Stinkhorns have a singular reproductive scheme that is testimony to the creativity of natural adaptation, generally a characteristic of higher order life forms. Unlike mushrooms, the fruiting body of the stinkhorn retains its stem-like shape as it emerges from the ground; there is no cap with gills on the underside to assist in wind-borne dispersion of the reproductive spores. The stinkhorn's spores are distributed in a slimy, deliquescent mass that is slathered around the top of the emergent column. The synomone smell is intended to be odious as it replicates the odor of carrion so as to attract insects, notably flies, for spore dispersal. A *synomone* is a chemical used as a signal among members of different species when both species benefit from the message. Pheromones are similar chemicals used to transmit smell signals such as sex or alarm among members of the same species. There are also allomones that benefit only the sender and kairomones that benefit only the receiver. The olfactory message system of arthropods is surprisingly complex. The "sporinators" feast on the slime, covering their legs with it in their bacchanalian revel, spreading the reproductive bodies of the stinkhorn after their reluctant departure. It is not clear if the relationship is symbiotic, as the flies may not derive any nutritional benefit from the fungus. The stinkhorn, however, depends absolutely on the flies.

William Needham

Phallus rubicundus looks very similar to the Elegant Stinkhorn, but its spore slime is carried on a small cap instead of directly on the stalk.

The peculiar and suggestive attributes of the stinkhorn fungus have engendered a broad range of colloquial beliefs and superstitions associated with their origin and with their effects on humans. In Germany, hunters once called the stinkhorn *hirschbrunst*, which roughly translates as "deer lust"; they believed that the stinkhorn emerged only in locations where stags had rutted. A probably apocryphal story attributed to Gwen Raverat and popularized by David Arora in the classic *Mushrooms Demystified* tells of her Aunt Etty's attempts to eradicate the stinkhorn: "With a deadly pounce, she would fall upon her victim and poke his putrid carcass into her basket" to be "brought back and burnt with deepest secrecy in the drawing room fire with the door locked - because of the morals of the maids." This attempt to prevent degenerate thoughts on the part of young Victorian Age women is given more credence as Aunt Etty was purportedly the daughter of Charles Darwin. It may not quite be what he intended as an example of "endless forms most beautiful and most wonderful."

Stinkhorns are also thought to have potential as palliatives for a variety of medical conditions. They were touted for ameliorating ulcers, gout, epilepsy, and if carried about as a sort of talisman, as a cure for rheumatism. There is no credible medical evidence to support any of these assertions. Most

William Needham

Dried stinkhorns for sale from an Asian market.

importantly, and in keeping with the doctrine of signatures, stinkhorns were thought to act as aphrodisiacs, imparting virility to the consumer; the phallic shape of the fungus providing the rather obvious signature of the penis for use to impart improvements to afflictions suffered thereof. Stinkhorns were at one time fed to bulls for this purpose in Europe. To achieve the desired effect in humans would also necessitate the ingestion of the stinkhorn, a gastronomic challenge given its rather mephitic aroma.

The stinkhorn erupts from an egg-shaped body called a volva when the environmental conditions favor spore dispersal. This occurs very quickly; according to folklore, you can watch it grow. It is these nascent stinkhorns that serve as the food source for mycophagists from Europe and North America. Called "devil's balls," by some, they are characterized as gelatinous and quite good when sliced and fried in butter. The consumption of stinkhorns is much more a cultural norm in China, where fungi are considered a substantive part of a normal diet. The most commonly consumed stinkhorn is the Basket Stinkhorn (*Dictyophora industiata*), which is a tropical variant with a netted veil. Dried packages of stinkhorn can be purchased at many Asian supermarkets.

Fungi in the News

Thomas Roehl
Newsletter Editor

Editor's Note: This article contains summaries of the biggest fungus-related news stories from the third quarter of 2016. Visit the link following each topic below for a closer look.

Lichens Require Two Fungi

In August, lichenology was shaken by a new study that revealed many lichens were composed of two fungi. Previously, lichens were thought to be composed of one fungus and one or more algae. However, the recent study on lichenized ascomycetes demonstrated that they also contain a basidiomycete yeast. The role of this yeast is not yet known, though its presence in lichens across the globe suggests it is important for lichen formation. Read more at: **http://www.nytimes.com/2016/07/22/science/lichen-symbiotic-relationship.html**

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6. Scroll to the bottom of the page and click "Save"

Bananas Extinct in 5-10 Years?

New research suggests that bananas could be extinct in five to ten years if nothing is done. Scientists sequencing the genomes of three fungal diseases of bananas (yellow Sigatoka, black Sigatoka, and eumusae leaf spot) found that two of the fungi had evolved genes necessary to control the banana's metabolism. The diseases were already able to attack their host's immune system. Their new ability makes them much more dangerous and could result in the extinction of the commercial banana in less than a decade. Read more at: **http://www.sciencealert.com/fungal-disease-could-wipe-bananas-out-in-5-to-10-years-say-scientists**

Fungi Recycle Batteries

Lithium-ion batteries are ubiquitous in today's world and are becoming increasingly expensive to manufacture. One solution is to recycle the lithium and cobalt from dead batteries. Currently, this process is energy-intensive and uses harsh chemicals. Scientists studying alternative recycling methods found that the fungi *Aspergillus niger*, *Penicillium chrysogenum*, and *Penicillium simplicissimum* were able to extract some lithium and cobalt from spent batteries. With some work, the researchers hope fungi can be used as an environmentally friendly option for battery recycling. Read more at: **http://www.forbes.com/sites/carmendrahl/2016/08/21/mold-might-be-the-future-of-recycling-for-rechargeable-batteries/**

Role of Fungus in Crohn's Disease

Researchers who examined the organisms present in the feces of patients with Crohn's disease consistently found the fungus *Candida tropicalis*. The fungus was present in higher concentrations than in healthy people. Patients with the disease also had above average levels of *E. coli* and *Serratia marcescens*. The authors of the study suggest that those three organisms work together to form biofilms, which protect the organisms and cause inflammation. This likely contributes to the symptoms of Crohn's and similar diseases. Read more at: **http://www.cbsnews.com/news/new-research-offers-clues-to-cause-of-crohns-disease/**

Fungus Kills Tagged Orca

A recently published review concluded that a killer whale that washed ashore in late March died due to a fungal infection introduced by a satellite tag. Researchers routinely use satellite tags to track the location of orcas to aid conservation efforts. Unfortunately, this tag carried a fungus with it when it penetrated the killer whale's skin. The orca already had a weakened immune system, so the opportunistic fungus was able to access the whale's blood stream and kill the animal within a month. The National Oceanic and Atmospheric Administration suspended its tagging program in response to the report. Read more at: **https://www.washingtonpost.com/news/animalia/wp/2016/10/10/a-geotagging-program-was-supposed-to-help-endangered-whales-instead-it-killed-one/**

C. auris Identified in U. S.

In early November, the Centers for Disease Control and Prevention (CDC) reported that it identified 13 cases of *Candida auris* in the United States. The CDC is concerned about the spread of *C. auris* because it is often resistant to antifungal drugs and it can spread in hospital settings. None of the U.S. samples showed the high degree of drug resistance found in strains from other countries. Six of the infections were identified from patient records and stored lab samples. *C. auris* is difficult to identify using standard equipment, so proper identification takes a long time. The CDC estimates that *C. auris* arrived in the U.S. within the past three years. Read more at: **http://www.cdc.gov/media/releases/2016/p1104-candida-auris.html**

Special Events

Mushroom Tasting

Thomas Roehl
Newsletter Editor

On August 27, MAW held a Mushroom Tasting at the picturesque Sandy Spring Museum in Sandy Spring, Maryland. The museum features local artwork and history, which served as a colorful backdrop to the aromas of cooking mushrooms. Over 50 people attended the sold-out Mushroom Tasting, making this one of MAW's most popular events of the year.

This was the first tasting event at MAW for the past couple years. With the success of this event, MAW hopes to return to the tradition of holding two tastings each year.

Ten MAW members cooked food on site and more brought in prepared dishes. There was a wide array of dishes for attendees to sample, from simple preparations that showed off the flavor of a certain mushroom to complex recipes that could be used as a meal.

Thanks to dishes on the basic end of the spectrum, members were introduced to the flavors of the Lion's Mane mushroom, *Fistulina hepatica*, and *Exsudoporus frostii*. The latter two mushrooms had been collected by MAW members at a foray earlier that day.

More complex dishes included: veggie and mushroom stew, chanterelle pasta, mushroom green curry, and oyster mushroom barbecue. Ray LaSala also brought in a Chinese-style mushroom dessert made with *Tremella fusiformis*.

After everyone had the opportunity to taste each dish, attendees had the opportunity to vote for their favorite dish. The winner of the contest and the 2016 Waldemar Poppe Culinary Award was Ophelia Barizo for her vegetable green curry with beech mushrooms. Second place went to Francesca Macchiarini's sautéed king trumpets with polenta. Third place was awarded to Rebecca Sears for her simple preparation of Lion's Mane mushroom.

Thomas Roehl

A MAW member samples Francesca Macchiarini's award-winning dish of sautéed king trumpets with polenta.

Thomas Roehl

MAW Culinary Chair Corinne Weible (left) presents member Ophelia Barizo (right) with the 2016 Waldemar Poppe Culinary Award at the Mushroom Tasting.

Thanks to the success of the 2016 Mushroom Tasting, MAW hopes to hold two tasting events in 2017. Traditionally, MAW held a Wild Foods Tasting in the spring to showcase foods prepared with wild plants as well as mushrooms and held a Mushroom Tasting in the fall to specifically highlight mushroom dishes. For more information on future tasting events, check the events section of **http://mawdc.org/** or look for announcements via email.

NAMA Shenandoah Foray

Thomas Roehl
Newsletter Editor

The North American Mycological Association (NAMA) Shenandoah foray took place from September 8 to 11. For the first time ever, NAMA's annual foray took place in Virginia. The foray was based out of the NoVa 4-H Center in Front Royal, Virginia. From there, small groups took buses to various locations in Shenandoah National Park and other nearby areas in search of mushrooms.

MAW partnered with the New River Valley Mushroom Club to plan and host the foray.

The clubs were able to work with Shenandoah National Park under the National Parks BioBlitz program. Thanks to this partnership, foray attendees were able to collect mushrooms for study from areas that would otherwise have been off limits.

325 people attended this event, making it one of the largest NAMA forays. About 30 professional mycologists were on hand to give lectures and assist in mushroom identification, including Walt Sturgeon, the foray's chief mycologist. At the end of the foray, collections of 315 specimens were preserved and sent to The Field Museum in Chicago and were also digitally logged into Mushroom Observer. This was an impressive number of species, especially considering the unusually dry weather during the weeks preceding the foray.

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Thomas Roehl

Jay Justice (center) identifies mushrooms for attendees of the NAMA Shenandoah Foray.

Thomas Roehl

The NAMA Shenandoah Foray offered various workshops. This array of colorful wool was created by participants in the dyeing workshop.

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Professional mycologists gave 20 lectures over the course of the foray. Topics ranged from examining specific groups of fungi to fungal bioremediation to mushroom cultivation and to issues in mushroom taxonomy and genetics.

Six workshops also took place during the foray. These introduced participants to such diverse topics as dyeing with mushrooms, mushroom photography, watercolor painting, microscopy techniques, and lichen identification. There was even a morning yoga class!

The foray also included social time in the evening, which allowed people to meet fellow mycophiles from other parts of the country and even talk to professional mycologists in an informal setting.

The weekend ended with Walt Sturgeon and Jay Justice walking through most of the species in the display room. Most people there were able to see a mushroom they had never found before, making this an excellent learning opportunity for everyone involved.

MAW President Mitch Fournet poses in front of a tree covered in Chicken of the Woods at the Sequaota Foray. *Photo: Thomas Roehl*

Annual Camp Sequanota Foray

Thomas Roehl
Newsletter Editor

MAW held its annual foray at Camp Sequanota in Jennerstown, Pennsylvania on the weekend of September 23-25. MAW has held a weekend foray at Camp Sequanota for over 30 years. This year's foray was attended by nearly 20 people, which made for a small but enthusiastic and energetic group.

There had not been much rain in the Sequanota area during the week leading up to the foray, but fortunately the ground was still wet from heavy rain a couple weeks prior. Foray attendees brought back lots of mushrooms representing a couple hundred species. Many of the small waxy caps and little brown mushrooms were unidentifiable, so the final species count was just over one hundred.

Some of the most interesting species collected were: *Calostoma cinnabarinum*, the Sweet Tooth Mushroom, the Destroying Angel, the Northern Tooth Fungus, and a yellow *Amanita muscaria*. The most plentiful mushroom was *Lactarius deceptivus*, which was very difficult to identify accurately.

The mushroom hunters returned with generous quantities of Chicken of the Woods and Hen of the Woods. Saturday night, the cooks prepared multiple dishes with each of these mushrooms, allowing foray attendees to sample different methods of preparation. Other mushrooms cooked that night included Honey Mushrooms, Black Trumpets, and *Hymenopellis furfuracea*.

Kim Roehl

Guest Mycologist Bill Russell (right) identifies a mushroom for foray attendees.

The Guest Mycologist for the Sequanota Foray was Bill Russell, a noted field mycologist and author of several books on mushroom identification. Bill's Saturday night presentation focused on unusual edible mushrooms. Bill enjoys eating mushrooms, so he eats many mushrooms that more casual collectors ignore.

For example, puffballs are usually left alone because they rarely taste great. According to Bill, the secret to making great puffballs is to prepare them within 30 minutes.

He also eats *Xerula radicata*, which most people avoid because it becomes slimy when cooked. Through trial and error, Bill found some ways to cook it that prevent it from becoming slimy.

Another unusual edible, *Clitocybe odora*, is the favorite mushroom of Bill's wife. She enjoys cooking with *C. odora* because of its unique anise-like aroma.

Bill explained that he also eats some mushrooms that field guides list as poisonous. It is difficult to assess whether or not a mushroom is poisonous because everyone reacts differently. Often, field guides take the cautious approach and label a mushroom poisonous even if only a handful of people have reported ill effects. Thanks to Bill's many years of experience in mycophagy, he knows which "poisonous" mushrooms do not make him sick.

Some of this was empirical. Certain mushrooms that were considered edible when Bill learned them have since been classified as poisonous.

Editor's Note: Most mushrooms in field guides listed as poisonous will make you sick and many can kill

you. Do not eat any mushrooms labeled poisonous. No mushroom is good enough to risk poisoning yourself. Only highly skilled identifiers like Bill Russell are qualified to experiment with potentially poisonous mushrooms.

Becky Johnson, a member of the Western Pennsylvania Mushroom Club and graduate student at Pennsylvania State University studying entomology, also gave a short presentation on the disease-carrying insects of North America. Although the topic was not directly related to fungi, it is important for everyone who spends a significant amount of time in the forest to be familiar with insect-borne diseases.

Ticks, mosquitos, and biting flies can all transmit diseases. Ticks receive the most attention, and rightly so. The carry Lyme disease, ehrlichiosis, babesiosis, Rocky Mountain Spotted Fever, and many more. Mosquitos do not transmit nearly as many diseases. In this part of the country, the most important mosquito-borne disease is West Nile virus. Biting flies rarely transmit disease, but it is possible.

The best way to avoid insect-borne diseases is by avoiding insect bites. For people venturing into the woods during tick and mosquito season, it is imperative to use an insect repellant such as DEET. Treating clothes with permethrin, which repels and kills insects, is another a good option. Becky prefers using permethrin because it lasts longer than DEET and you do not have to worry about applying it in the field.

Thomas Roehl

MAW First Vice President William Needham (left) identifies a mushroom for visitors at the Mushroom Fair.

MAW Mushroom Fair

Thomas Roehl
Newsletter Editor

MAW's annual Mushroom Fair was held on the afternoon of October 9 at Brookside Gardens, which had been closed for the past few years due to renovations. MAW was unable to host the fair during the construction, so members were excited to see the return of this public outreach event. The fair was kept small, but an estimated 500 people walked through the display room, attended lectures, and went on forays.

Mitch Fournet and Bruce Boyer led groups on forays in and around Brookside Gardens. Participants returned with lots of mushrooms and managed to fill the display tables by the end of the event. Attendees brought in lots of *Chlorophyllum molybdites*, which was the largest gilled mushroom on display. Other mushrooms that were found included large puffballs, Jack-O-Lantern mushrooms, Parasol Mushrooms, some boletes, a couple Hens of the Woods, and many smaller mushrooms.

Tovi Lehman, Jon Ellifritz, and William Needham gave lectures that introduced people at the fair to mushroom cultivation, mushroom identification, and mycology. A few MAW members helped identify mushrooms while others staffed tables around the room. There were tables advertising MAW and NAMA, a table introducing mushroom cultivation, and one demonstrating foray preparation. Francesca Macchiarini, Ray LaSala and Opheliaa Barizo demonstrated cooking with mushrooms and handed out samples of dishes to members of MAW, much to their delight.

Danny Barizo

Walt Sturgeon (left) joined MAW Second Vice President Connie Durnan (center) and MAW member Danny Barizo (right) to help introduce students to mycology at the Highland View Academy STEMFEST.

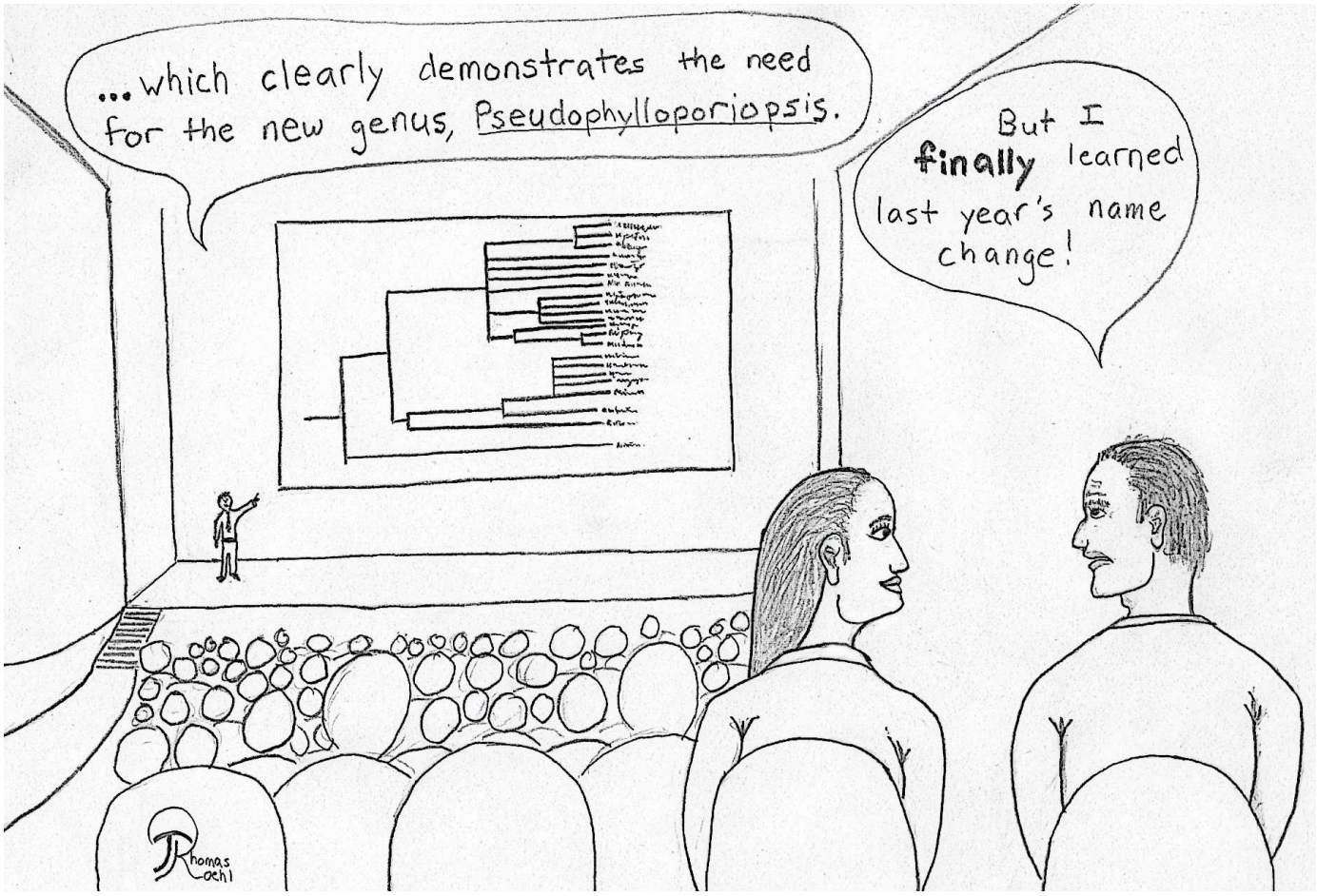
Walt Sturgeon Speaks at STEMFEST 2016

Danny Barizo
MAW Member

Walt Sturgeon, chief mycologist of the recent North American Mycological Association foray in Shenandoah, VA was the guest speaker at STEMFEST 2016 held at Highland View Academy in Hagerstown, MD on October 23, 2016. STEM stands for Science, Technology, and Engineering Mathematics. STEMFEST is a yearly event aimed at encouraging young students to pursue STEM related fields. The event drew over 500 people, mostly elementary and high school students.

Walt spoke about many aspects of mycology including the important role mushrooms play in the ecosystem. He touched on medicinal, poisonous, edible, and mind altering mushrooms. Most of the attendees were students, but also included people who heard about the lecture through MAW emails or the MAW Meetup group.

The Mycological Association's booth at the event was manned by MAW Second Vice President Connie Durnan and club member Danny Barizo. MAW displayed materials on two tables and give away brochures on mycophagy, mycology, and the club itself. Fruiting shitake logs, oyster mushroom growing kits, and wild mushrooms were also on display. Because of the time of year, the wild mushrooms consisted of mostly hens of the woods.


...which clearly demonstrates the need for the new genus, Pseudophylloporiopsis.
But I finally learned last year's name change!
Thomas Lochl