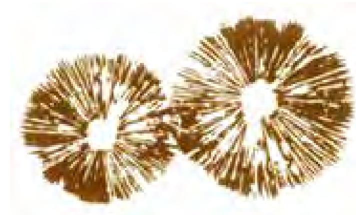
SPORE PRINTS



BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY
Number 508 **January 2015**

COOKIE BASH EDIBLE ART WINNERS

First Place - James Nowak

Second Place - Barbara & Iris Picat

Third Place - Shannon Adams

FUNGI MAKE PLASTIC WASTE A TASTY TREAT

Tracy Staedter
http://news.discovery.com, Dec. 11, 2014

As Homer Simpson might say, "Mmmmmm….plastic."

The Austria-based Livin Studio together with Utrecht University has developed the Fungi Mutarium, a kind of incubator designed to cultivate edible fungi that digest plastic as they grow.

The two main fungi used are already eaten in households around the world: *Pleurotus Ostreatus*, or Oyster Mushroom, and *Schizophyllum Commune*, or Split Gill, which is common in Asia, Africa, and Mexico.

"Both fungi show characteristics to digest waste material while remaining edible biomass," Livin Studio founder Katharina Unger told Dezeen.

But in this case, the mushrooms are grown in edible egg-sized pods made from agar, derived from seaweed. A culture of mycelium—the fibrous part of the mushroom—is added to the pod along with some plastic. As the culture of mycelium grows, it digests the waste material and fills up the little egg-sized pod.

Once the pods are filled, just pop one in your mouth. The entire pod and its contents are completely edible.

At the moment, the full digestion process takes a couple of months, but Unger and her team are investigating ways to speed it up. The system was conceived to work in tandem with other forms of farming. "We imagined it as being used with a community or small farm setting," Unger told *Dezeen*.

credit: *Livin Studio* via *Vimeo* via *Dezeen*

AN EXPENSIVE MISTAKE

Holley Simmons
The Washington Post, Dec. 10, 2014

On a recent Sunday afternoon, Ellen Kassoff Gray was passing through the dining room at Equinox, which she co-owns with her husband, chef Todd Gray, when something sitting on a diner's bread plate caught her eye: a white Alba truffle the size of a silver dollar with a bite taken out of it.

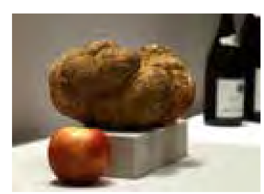
Earlier that day, chef Gray had placed a few of the pricey fungi in a glass case to promote the restaurant's new offering—a vegan brunch buffet with truffle shavings for a $20 surcharge. The diner must have mistaken the floor models as up for grabs.

Kassoff Gray politely approached the diner, who told her she didn't like the taste and suggested the chef salvage the unbitten part.

"I took it over to Todd and showed him, and he said, 'That's a $300 bite!'" Kassoff Gray says. "It was one of the costs we had to eat, literally."

MASSIVE TRUFFLE SELLS FOR MORE THAN $61,000 AT AUCTION

The Associated Press
http://www.nbcnews.com/, Dec. 8, 2014



A record-setting 4.16 lb white truffle has sold for $61,250 at a New York City auction. Sotheby's says the fungus was sold Saturday to a food and wine lover from Taiwan bidding by phone.

The truffle was found last week in Umbria, Italy, by Sabatino Truffles. The firm turned down million-dollar offers from buyers in China. Instead, it chose to auction the truffle in New York to benefit Citymeals-on-Wheels and the Children's Glaucoma Foundation. Sabatino Truffles spokeswoman Jane Walsh had said the truffle was slightly smaller than an American football. She says the average white truffle that's unearthed is about the size of a walnut. Sotheby's says the previous largest white truffle ever found was 2.5 lb.

Spore Prints

is published monthly, September through June by the

PUGET SOUND MYCOLOGICAL SOCIETY
Center for Urban Horticulture, Box 354115
University of Washington, Seattle, Washington 98195
(206) 522-6031 http://www.psms.org

CALENDAR

Jan. 13 Membership Meeting, 7:30 pm, CUH
Jan. 20 Board Meeting, 7:30 pm, CUH
Jan. 20 *Spore Prints* deadline

“MAGIC” MUSHROOMS FOUND GROWING ON BUCKINGHAM PALACE GROUNDS

Robin de Peyer
London Evening Standard, Dec. 12, 2014

Hallucinogenic mushrooms have been found growing in the grounds of Buckingham Palace.

Television gardener Alan Titchmarsh stumbled across the distinctive *Amanita muscaria* mushrooms during a tour of the 40 acre grounds with an ecology expert while filming “The Queen’s Garden” for ITV, set to be screened this Christmas. “That was a surprise, but it shows just how varied the species are,” Titchmarsh told the *Sun*. “As the program explains, they are beneficial to trees, increasing their ability to take in nutrients.”

The hallucinogenic properties of the mushroom have been well-known for centuries and have been used in religious and shamanistic rituals, according to the Kew Gardens website. But it is not widely considered desirable for recreational use.

Royal officials emphasized that fungi from the garden are not used in the palace kitchens.

MEMBERSHIP MEETING

Tuesday, January 13, 2014, at 7:30 pm at the Center for Urban Horticulture, 3501 NE 41st Street, Seattle


David Pilz

Our speaker for January is mycologist David Pilz, formerly with Oregon State University and the USDA Forest Service who now has his own company. In early August 2013 David had an interesting opportunity to attend a workshop on edible mushrooms in Guatemala. Afterward he was able to tour the country with fellow mycologists. In his talk, entitled “Mayan Mycology in Guatemala & What is IWEMM7?” he will recount stories of the adventure with colorful images for illustration. Topics will include the meeting, the eternal spring of the forested Mayan highlands, an update on tourism in Guatemala, the ancient mushroom traditions of the indigenous Maya, mushroom stone stories, and opportunities for new mycological research in this fabulously diverse country.

David Pilz is a consultant and writer through the auspices of his business, PilzWald—Forestry Applications of Mycology. He was formerly a Forest Mycologist with the Department of Forest Science at Oregon State University in Corvallis, where he conducted research on harvested forest fungi, with an emphasis on compatible production of edible mushrooms in forests managed for timber and other amenities. This research focus evolved from 9 years of research with the Pacific Northwest Research Station (USDA-Forest Service) on the productivity and sustainable harvest of edible forest mushrooms. Contact information and downloadable publications can be obtained at www.pilzwald.com.

Would people with last names beginning with the letters A–K please bring a snack or treat to share after the meeting.

VIETNAM STRAWBERRY FARMER KILLS FUNGUS SPORES WITH ELECTRIC CURRENT

http://english.vietnamnet.vn/, Dec. 7, 2014

Strawberries were brought to Vietnam by Europeans in the 19th century. In 1940, the first strawberries were planted by the French in Da Lat City, believed to be the land most suitable for the plant in the country.

The strawberry cultivation method in Da Lat remains unchanged. Farmers cultivate saplings they split from the main plants.

Over dozens of years of development, strawberries in Da Lat have been affected by diseases which have led to lower yield and quality. This has forced farmers to use more and more plant protection chemicals, especially fungicides.

Previously, in order to be able to harvest strawberries after two months of cultivation, farmers had to spray pesticides once every three days. However, nowadays, since the plants are attacked by too many diseases, farmers have to spray chemicals every day.

A report from the Lam Dong City Department of Agriculture and Rural Development released two years ago showed that the pesticide residue found in strawberries was 8–12 percent, unsafe for people.

In an effort to save the Da Lat strawberry brand, scientists and businesses tried to import strawberry varieties from the US, Taiwan, New Zealand, and Europe to replace the old varieties.

Meanwhile, some farmers in Da Lat tried the hydroponic technique to grow strawberries. However, the cultivation method was too costly, discouraging farmers.

Nguyen Thanh Trung, a mechanic and farmer in Da Lat, decided to set to work on a solution to kill insects and protect strawberries from diseases while not using chemicals.

According to Trung, the biggest problem in the hydroponic method is that it is very difficult to measure how much fertilizer the plants need. Trung had to work days and nights to find the optimal formula for mixing fertilizer for strawberries through drip irrigation.

As Trung repeatedly failed to find the formula, he wanted to give up his plan many times. However, he was fortunate in receiving financial support from a food company in HCM City, which helped him continue his work.

One day, Trung accidentally heard an advert that a company was selling electric water which can kill fungi and pathogens, which prompted him to think of killing fungi spores with an electric current.

“Now I can kill bacteria and fungi gently with electricity, and there is no need to use pesticide,” he said.

One kilo of Trung’s strawberries sells for VND 300,000, several times higher than the market price. His strawberries have sold like hotcakes because consumers have been reluctant in recent years to buy products that have a high pesticide residue, preferring cleaner products.

THE MIGHTY BIRCH POLYPORE, KING OF THE BRACKET FUNGI

abovetopsecret.com, Dec. 1, 2014
via *The Spore Print*, LA Myco Soc., Dec. 2014

All hail *Piptoporus betulinus* and bow down to the sheer wonder of what it can do for someone stuck alone in the woods! I love these mushrooms. They grow all over the place by me on just about any Birch tree (Silver and Downy Birch in my locale) that is dead or dying, and that’s usually about half of them, whether they be standing or fallen. And once you see one of them, you’ll begin to notice that they are all over forests with Birch in them, and they’ll swiftly become one of the resources that you spot first, because they really are bloody useful! Otzi the Iceman carried the stuff, and you’ll see why soon enough.

Birch polypore,
Piptoporus betulinus.

Some can grow to the size of a dinner plate; they are easily broken off and exist in such profusion on dead or dying Birch trees that there is no guilt or damage to anything in taking one when many others can be found nearby. They are distinctive, as long as you can tell a Birch from a Beech (and you will therefore avoid the slimy but similar Ganodermas) and they are not poisonous. In fact according to Wild Food UK they are edible. In my experience I’d rather dig to the bottom of the laundry basket and eat the oldest sock I could find; still, this kind of knowledge can save lives. But this is the very least of their properties.

They used to be commonly known as “Razor Strop Fungus” for their ability to finely hone knives and razors. Just pick a larger example and cut out a rectangular block of it. It’s got a polystyrene like density/resistance to cutting when fresh, but dries hard—and when dry simply hone or strop in a normal fashion. Alternatively glue a little slice to a stick for a smaller strop. As long as you keep it dry and away from burrowing insects it will last for months at least, I’ve had some that lasted for two or three years.

Just like the Tinder Hoof Fungus, Birch Polypores are great for fire lighting, and dry powder or fine shavings take a spark and make a decent tinder. Not only this, they can also be used to carry an ember as a block of the stuff will smolder for a couple of hours or more if treated with care—make a container of Birch bark (for example), line the bottom with fresh leaves, insert the smoldering lump and then sprinkle with its own shavings and dust. Ensure air can get to it by adding some holes in the container and with practice you will be able to start a fire with it later in your travels.

The smoldering property can be used in another way too. It gives off an acrid smoke that gnats and mosquitoes will avoid. Set some smoldering in a bowl or on a stick and you won’t get bitten half as much as you would otherwise.

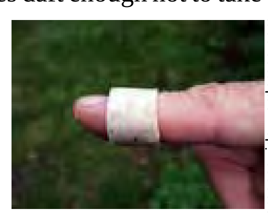
They are also medicinal and contain the antibiotic Piptamine. Otzi may have been carrying birch polypore as a preventive medicinal cure. Perhaps the polypore was used to help retard or rid himself of metazoans and mycobacteria from his body.

According to Paul Stamets, medicinal properties of birch polypore include that it stops bleeding, prevents bacterial infection, is an antimicrobial agent against intestinal parasites and has anti inflammatory effects. The fungus shows antiviral properties that may be of help in times of HIV outbreaks and other biodefense threats. Betulinic acid of this fungus may act on malignant melanoma and other tumor development. Pretty awesome huh? Well I’m going to enthuse a little more.

You can also make woodland plasters from the stuff—I’ve treated my own jagged bow-saw cuts on fingers with the stuff, and very effectively. Find one of them that has a nice clean white underside. This thin (under 1 mm approx.) bottom layer is of a felt like texture, and by slicing a rectangular section of this off you can wrap it around a finger for example (the inner layer should be touching the wound, not the potentially dirty outer layer) and tie with a little grass.

It will quickly dry hard and adhere to itself quite effectively, making it stay in place without binding, retarding minor bleeding and aiding in healing as well as protecting the wound from dirt and infection if like me, you’re sometimes daft enough not to take a first aid kit with you into the woods. Obviously clean the wound as soon as you are able

Otzi even used lumps of the stuff, in the opinion of myself and a few others, as pegs to secure items to his tool belt. So thank you for reading, I hope it’s of use to someone someday.



Bandage made from birch polypore.

RAT SKULL FOUND IN WOOLWORTHS' MUSHROOMS

JeVanne Gibbs

The Citizen, Dec. 10, 2014

South Africa - In the latest Woolworths' blunder, a customer has discovered what appeared to be the skull of a rat in a packet of sliced mushrooms. Woolies customer Alison Matthews said she was "absolutely disgusted to say the least."

Matthews had purchased the mushrooms from a Woolworths store in Amanzimtoti, and made the discovery when she arrived home to cook dinner.

Rat skull in mushroom package.

"It's a good thing I didn't just empty the mushrooms straight into my meal… can't even imagine how disgusting that would have been especially considering that I cook for my children," said Matthews.

"This is just beyond shocking given the exclusivity that Woolworths pride themselves on. So much for spending a bit more and getting quality," she added.

In response to Matthews' complaint, Woolworths said: "We're shocked to see this, Alison; sincere apologies for the experience. Our customer team are looking into this matter urgently and will be in touch with you very soon."

Just over two weeks ago a Woolworths customer reportedly found a dead frog in his salad. On Tuesday, *The Citizen* reported that a customer had found another frog inside a sealed Woolworths salad. According to the customer, the frog was still alive. A number of bugs and objects have since been found in Woolworths' food products.

POISONOUS MUSHROOMS COULD BE KEY TO DRUGS WITHOUT SIDE EFFECTS

Ryan Whitwam

http://www.geek.com/science/, Dec. 7, 2014

Some species of mushrooms are perfectly safe to eat, but others that look very similar can land you in the hospital or worse. In studying how these fungi manage to be so poisonous, a team of Michigan State University researchers may have found a way to create a new generation of pharmaceuticals with highly targeted effects. Imagine chemotherapy drugs with no side effects or antibacterial agents that can clear out severe infections without damaging other tissues. That's what poisonous mushrooms could do for medicine. Specifically, it's an enzyme used by these fungi to manufacture poisons.

This research used mushrooms of the genus *Amanita*, which includes the notorious death cap mushroom. These fungi produce quite a lot of proteins, but a few are incredibly toxic if ingested. Not only that, but these are hearty little proteins. They can survive cooking and exposure to stomach acid just fine, then pass into the bloodstream. It isn't until they reach the liver that their deadly effects are felt. The hepatotoxic effects of α-amanitin proteins can cause permanent liver damage, as well as death without treatment. You definitely don't want to get α-amanitin anywhere near your mouth, but it's the way this protein survives all the way to your liver that has scientists interested.

Toxic compounds like α-amanitin are what are known as cyclic peptides. Like all proteins, they are composed of chains of amino acids, which are assembled in cells. However, cyclic peptides are linked together by a strong covalent bond in a ring orientation rather than being folded up and held together by weaker interactions. This makes a cyclic peptide extremely durable, ensuring it can survive the journey through your digestive track and end up wherever it needs to go.

The MSU team was able to pull apart the *Amanita* toxins and study the way they are produced. This led to the discovery of a second enzyme used in the mushroom's cells called POPB. This is what takes the freshly produced linear chain of peptides and converts it into a nearly indestructible ring that delivers a deadly payload to your liver. Of course, that's not the goal of the medical research. Pharmaceutical researchers want to use POPB to create new drugs that can carry therapeutic compounds through the body instead of deadly toxins. You have to admit, that sounds better.

POPB itself isn't a drug that will cure anything. It's like you had a missile carrying a nuclear warhead, but you were able to pry out the nuke. Now you're left with a missile that could be used to deliver something other than unstoppable atomic fire. The problem is figuring out how to formulate the payload to do the most good. The team has already designed several hundred compounds that could be transformed into cyclic peptides, but that's only the start. There could be billions of potential variants, and most of them won't be of any clinical significance. One of them might be the magic bullet, though.

FUNGUS MAY BE THE MARSHAL THAT TAMES THE WILD TUMBLEWEED

www.centralvalleybusinesstimes.com/, Sept. 22, 2014

See them tumbling down
Pledging their love to the ground
Lonely but free I'll be found
Drifting along with the tumbling tumbleweeds.

The 1930s song, written by Bob Nolan and ranked as one of the top Western songs of all time, probably is not being sung by scientists with the USDA's Agricultural Research Service, toiling in a sealed lab in Frederick, MD, about as far east of tumbleweeds as one can get in the U.S.

Instead, they're trying to find a way to eradicate the icon of the song, the tumbleweed.

Blown across the highways of the Central Valley, the lightweight weeds are a ubiquitous pest. Popularly depicted in movies and television tumbling through dusty towns of the Old West, tumbleweed—*Salsola tragus*, also known as Russian thistle—is in fact one nasty hombre of the western American landscape, elbowing aside crops, clogging irrigation ditches, spreading insect pests, and even posing a driving hazard.

Large-scale infestations, especially on low-value agricultural lands, can make chemical or cultural control too costly or impractical, according to U.S. Department of Agriculture plant pathologist Dana Berner, who works at the Agricultural Research Service Foreign Disease-Weed Science Research Unit in Frederick, MD.

But beneficial fungi could become microbial marshals tasked with wrangling the weedy icon into submission, if the ARS work is successful.

In studies at Frederick, Berner and his colleagues are evaluating certain fungi with potential to biologically control tumbleweed, an invasive species that entered the United States in the 1870s as a flax seed contaminant.

Their most promising fungal candidates, *Uromyces salsolae* and *Colletotrichum salsolae,* were originally isolated from infected thistle plants in Russia and Hungary and exported to the ARS Frederick lab under permit for quarantine study. In Biosafety Level-3 (the second-highest safety level) greenhouse containment, the researchers exposed plant specimens from 64 different species to *U. salsolae* and 89 species to *C. salsolae* and gauged the plants' reactions and disease symptoms, if any.

To broaden the scope of their host-range tests—critical to ensuring the fungi won't harm non-target plants or crops once released—the team used an approach called "BLUPs," short for "mixed model equations that produce Best Linear Unbiased Predictors." Using a disease-ranking system and matrix information, BLUPs predict a plant species' susceptibility based on how genetically similar it is to the targeted weed—Russian thistle, for example.

Based on the information, the researchers have submitted petitions seeking recommendation for release of the two fungi from the Technical Advisory Group for Biological Control Agents of Weeds, which comprises members from federal and state regulatory agencies, as well as from Canada and Mexico.

TAKING ON SPAIN'S MUSHROOM MAFIAS

Guillermo Altares

http://elpais.com/, Dec. 9, 2014

This fall the Civil Guard has carried out a series of operations throughout Spain as part of a crackdown on illegal harvesting of wild mushrooms that has seen organized gangs of up to 50 people camping out in woodland for weeks on end and stripping forests of valuable species.

Castilla y Leon Regional Government

Crates of confiscated fungi in Soria.

"There is huge demand," explains a spokesman for the force's Seprona environmental protection unit. "It's like drugs: there is always somebody prepared to buy."

He adds that so far the Civil Guard has been unable to establish who is behind the practice. "But it's clear that there are wholesale buyers. The whole thing is very well organized and structured. So far, we don't know who is selling the mushrooms."

"This is a problem that has been brought about by the economic crisis," explains Arturo Notivoli, the head of Seprona in the Pyrenean province of Huesca, who adds that they first began to see camps dedicated to collection on a huge scale a few years ago. Mainly made up of Romanians, according to the Civil Guard, the gangs move around the country depending on the season and the presence of the police. Palencia, in the north of the Castilla y León region, was hard hit in 2013, but has seen no activity from mushroom gatherers this year. But in the tiny province of Soria, around 200 kilometers northeast of Madrid, and one of Spain's richest sources of mushrooms, the authorities say almost 700 complaints have been filed by local residents, resulting in the seizure of 15 tons of mushrooms. A kilo of *Lactarius deliciosus,* better known in Spain as *níscalos*, can cost up to €30, while different varieties of *Boletus* can reach three times that figure.

Castilla y Leon Regional Government

Wild mushrooms seized in Soria.

Signs posted along Soria's back roads warn that mushroom gathering is tightly controlled and that large-scale collection is forbidden. During the season, the entire region seems dedicated to mushrooms, with hotels and restaurants offering special dishes, along with guided tours to identify species, tastings, and special markets where freshly picked mushrooms can be bought directly. Anybody wishing to collect them must have a permit issued by their local town hall, and only local residents on the electoral register can collect to sell.

In the main square of the tiny village of El Royo, nestling among the hills of Soria, Alfredo and Ángel, two locals in their sixties, are about to head out to the surrounding woodland in search of mushrooms. They say they have often come up against large groups of Romanians, but say the foreigners are in the minority. "There are many more Spaniards collecting mushrooms than Romanians, but because of xenophobia, they get all the blame, although it has to be said that they leave a lot of rubbish behind," says Alfredo. "There are buyers who take advantage of them and then sell the mushrooms on at much higher prices."

A local forest ranger says that this year, Soria has been particularly hard hit by unregulated mushroom gathering.

"We've been invaded," adds his colleague. "The problem is that the Romanians are organized: they are brought here, and what they collect already has buyers. They live in terrible conditions. They sleep out in the open on hillsides, or in vehicles, anywhere

cont. on page 6

Mushroom Mafias, *cont. from page 5*

they can find shelter. They are paid much less than local people are.

"They travel round Europe, they follow well-established routes, but they get into the most amazing places, locations that not even we knew about where mushrooms can be found."

With the exception of Palencia, where large-scale collecting of mushrooms without permission is considered theft only if their value surpasses €400 (there were 60 arrests in 2013), in the rest of Spain, it is considered a minor infringement of the law and subject at most to a small fine. But local authorities are trying to crack down on unregulated mushroom gathering by fining people for littering, or even by checking that their motor vehicles' paperwork is in order.

The authorities in Soria say they still have little idea as to where these tons of mushrooms end up. In the entrance to the small community of San Leonardo de Yagüe one chilly November afternoon, a group of Romanians is selling crates of mushrooms out of their cars. They say this wholesale activity is legal, although others say that unlawfully collected mushrooms are sold for as little as one euro a kilo to local people with licenses, who then sell them on for up to four times that price to intermediaries.

But Álvaro Picardo, the head of the environment department in the regional government of Castilla y León, says the trade in mushrooms goes far beyond meeting local demand: "There are buyers out there who channel this unregulated trade into the wholesale markets that supply shops and supermarkets."

In which case, what about the danger to consumers from potentially poisonous mushrooms? "The people who collect these mushrooms know what they are doing, they don't make mistakes," says Gabriel Moreno Horcajada, president of the Madrid Mycological Society.

SCIENTISTS SEEK CURE FOR DEVASTATING WITCHES' BROOM DISEASE OF THE CHOCOLATE TREE

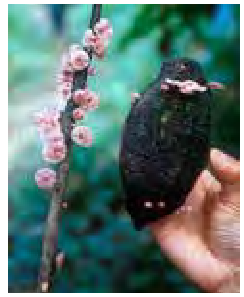
American Society of Plant Biologists, Oct. 31, 2014
via *The Spore Print*, LA Myco Soc., Nov. 2014

In the early 1900s, Brazil was the world's largest producer of cocoa. Chocolate trees (*Theobroma cacao*) were cultivated in a 800,000 ha region of rainforest in the state of Bahia, beneath a dense canopy of native shade trees.

Whereas the surrounding rainforest was a biodiversity hotspot, the chocolate trees, which were derived mainly from a handful of seeds introduced in the mid 1700s, had very low levels of genetic variation. According to Brazilian scientist Gonçalo Pereira, "This scenario created a very romantic, but extremely fragile situation." Genetic variation is important for a population's survival, as genetically variable populations are more resistant to pathogens.

Cocoa pod infested with M. perniciosa.

In 1989, disaster struck in the form of a devastating fungus named *Moniliophthora perniciosa*. In a ten-year period, the fungus eradicated around 70 percent of Brazil's chocolate trees, resulting in an economic and social catastrophe that affected two million people.



M. perniciosa *fruiting on limb and cocoa pod.*

At one stage of its lifecycle, *Moniliophthora perniciosa* takes on the form of enchanting pink mushrooms that seem to come straight from a fairytale (see picture). For the chocolate tree, however, *M. perniciosa* spells trouble. These mushrooms are filled with millions of spores that, once released, can enter a susceptible chocolate tree through surface wounds and tiny gaps called stomata and slowly kill the tree.

Because infected trees develop bizarre green outgrowths that resemble brooms, the disease is known as witches' broom disease. Two to three months after infection, the brooms turn brown and begin to perish. The fungus then completes its lifecycle by once again giving rise to clusters of spore-producing mushrooms. There is no known cure for this devastating disease.

In 2000, a team of scientists led by Gonçalo Pereira of the Universidade Estadual de Campinas in Brazil initiated the Witches' Broom Genome Project, with the long-term aim of developing a cure for witches' broom disease. A study to be published in *The Plant Cell* represents the culmination of their research to date. The team used a technique known as dual RNA-seq analysis to monitor the interaction between the *M. perniciosa* fungus and the chocolate tree. This technique allows scientists to reconstruct the battlefield between the chocolate tree and the fungus in unprecedented detail, by providing a readout of genes that are affected in the plant and the fungus during the course of witches' broom disease. "Knowing the molecular and physiological basis of a disease is an important step towards developing effective control strategies," says study author Paulo Teixeira.

Using healthy plants as a reference point, the scientists identified 1,967 genes that exhibited unique activities in the green broom structures of infected chocolate trees. An analysis of these genes showed that fungal infection triggers massive changes in the metabolism of the chocolate tree. Additionally, the scientists discovered 8,617 fungal genes that were active in green brooms. Using the Witches' Broom Disease Transcriptome Atlas, a publicly available online tool developed by Pereira's team to support studies of witches' broom disease, the scientists identified 433 fungal genes that were particularly active in green brooms. Many of these genes encoded proteins with presumed functions in the fungal disease mechanism. Study author Daniela Thomazella explains that "The discovery of sets of fungal genes that are most likely involved in pathogenicity paves the way for the development of targeted treatments of the disease."

Indeed, the authors are already using the results of this study to develop a novel fungicide that specifically targets *M. perniciosa*. In addition to increasing our knowledge of a devastating tropical disease, lead scientist Pereira maintains that this work provides an important basis for future studies that aim to improve agricultural sustainability and global food security.

A truly good book is something as wildly natural and primitive, mysterious and marvelous, ambrosial and fertile as a fungus or a lichen. —*Henry David Thoreau*

MUSHROOM STAMPS FROM PERU **Brian S. Luther**

In the past several years I've written a number of articles discussing the postage and postal items illustrated with fungi issued so far from all the northern North American countries, from Mexico north, including one territory (Luther, 2013a,b,c,e and 2014a,b). Starting with this article I'd like to delve into the mycophilatelic items issued from the Central and South American countries.

Peru is the third largest country in South America, about three-quarters the size of Alaska, so it covers a really big area. It has three distinct geographic regions: the western plain along the Pacific Ocean, the Andes region (with the highest peak being Huascaran at 22,205 ft), and the part (nearly 60 percent) extending into the Amazon basin off the eastern slope of the Andes. It's a country of amazing biodiversity.

Peru has issued two sets of mushroom stamps so far: a four value set in 2007 and two stamps in 2010. The 2007 set was designed on a really cute souvenir sheet in the shape of a mushroom. FDCs (first day covers) were also issued for these.

Scott 1595a–1595d - *Issued 10/15/2007*

Brian S. Luther

Peru. Value s/. 2.50 (s/. = nuevo sol).
Titled Hongos peruanos (Peruvian mushrooms).

Scott 1595a is labeled and misspelled as "*Dyctiophora indusiata*." The correct spelling for that genus is *Dictyophora*, but this stinkhorn is now in the genus *Phallus*, as *P. indusiatus*. It may come as a surprise that this fungus is widely eaten in Asian countries and has been successfully cultivated in China on a large scale. The immature basidiocarps, or "eggs," can also be eaten fresh. Eating a stinkhorn? "No way," you say; but the real answer is "way." The smelly spore mass is washed off, and the mushroom is dried and preserved for future use. In the past few years there has been some fascinating research done on the chemicals causing the foetid odor of this fungus and their peculiar physiological effects on humans.

Scott 1595b is labeled *Sepultaria arenicola*, but it's incorrectly identified, unfortunately. As you can see, the photo shows a bright scarlet colored Discomycete, but *Geopora* (*Sepultaria*) *arenicola* has a boring grayish to creamy to pale yellowish hymenium and grows in sandy soil, not on wood as the fungus on this stamp is shown. I believe this is actually *Phillipsia domingensis*, a bright red-orange, lignicolous species very common in tropical areas in both the Old and New World. Another similarly colored tropical Discomycete genus is *Cookeina*, but it differs from *Phillipsia* by having pronounced marginal hairs on the cup, which are not shown on the illustration on this stamp. In an earlier article on Australian postage with mushrooms I showed a stamp from Christmas Island with *P. domingensis* on it (Luther, 2012). Hansen et al. (1999) did an excellent DNA study of the genus *Phillipsia*, if you're interested.

Scott 1595c is labeled *Marasmius haematocephalus*. This is a widespread tropical American species. The color of the cap varies from purplish to a dark reddish. Dennis (1970) has a beautiful water color illustration he did of a clear, light purple form from Venezuela. There are a number of small countries in the Lesser Antilles (volcanic islands extending in an arc from northern S. America toward Cuba in the Caribbean) that have issued mushroom stamps featuring this species, including Antigua and Barbuda, Grenada, Nevis, St. Kitts, and the Turks and Caicos Islands.

Scott 1595d is labeled *Marasmiellus volvatus* and this appears to be accurate.

The FDC for this set has a cancel in the same shape (and the same words) as the large stylized mushroom.

Scott 1735a–1735b - *Issued 2010.*

Brian S. Luther

Peru. Value s/. 6.0 Titled Hongos (mushrooms).

The first of these stamps (Scott 1735a) has a single mushroom identified as Suillus "luteos," which is a misspelling of *S. luteus*, commonly called Slippery Jack. It also shows in the background two purple capped and one red capped mushroom. I can't tell what the purple mushrooms are, because I can't see under the caps, but the red mushroom looks like a species of *Russula*.

Scott 1735b shows one central *Pleurotus cornucopiae* and several younger specimens underneath. What's actually labeled on the stamp (*Pleurotus-cornucopiae*) has an inappropriate hyphen between the genus and species names.

As I pointed out in an earlier article (Luther, 2013d), identification and spelling errors are somewhat common on mushroom stamps.

cont. on page 8

Peru stamps, *cont. from page 7*

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MUSHROOM ASTROLOGY

Bob Lehman, LAMS

Capricorn (Dec. 22–Jan. 19): You are plodding but thorough in your mushroom hunting. While Aries has gone off to explore a distant grove of trees and Sagittarius is busy extolling the virtues of mushroom hunting, you work your way through well-tested hunting grounds and find a respectable number of mushrooms. Your organizing and planning abilities can be valuable in making a foray successful. You make careful identifications before eating anything.

RETURN SERVICE REQUESTED

Puget Sound Mycological Society
Center for Urban Horticulture
Box 354115, University of Washington
Seattle, Washington 98195

Rare Bolete Brought into the CUH ID Clinic

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On Monday, October 27, 2014, a beautiful, bright red little bolete was brought in to me at the Hildegard Hendrickson ID Clinic. I was not able to give the collector a definitive ID because it was a species I just didn't know. It had all the features of an introduced eastern North American species, but upon closer examination it turned out to be intermediate between four North American and European species: *Boletus campestris*, a species known only from the mid-west and eastern North America; *Boletus coccyginus*, native to California; *B. flavorubellus*, known only from Michigan, and *B. rubellus*, known from eastern North America and Europe. For now, I'm calling it the Seattle Rosy Red Bolete.

Because of the rarity of this bolete, I'm providing a detailed macroscopic and microscopic description of the collections here. References for *B. campestris*, *B. coccyginus*, and *B. flavorubellus* mention that no data are known on macro-chemical reactions, nor is any information on edibility. So I did a series of chemical tests on my Seattle collections and also tasted and sampled the mushroom both fresh and cooked. The results are given below. All colors in quotes are from Ridgway (1912).

Collections Studied—*Boletus* sp., Seattle Rosy Red Bolete

(1) BSL coll. #2014-1027-1. In soil in a North Seattle yard, associated with *Betula pendula* (European White Birch), and *Picea pungens* (Colorado Blue Spruce), King Co., WA State, Oct. 27, 2014.

(2) BSL coll. #2014-1028-1. Oct. 28, 2014, otherwise all collection data the same.

(3) BSL coll. #2014-117-1. Nov. 7, 2014, otherwise all collection data the same.

Seattle Rosy Red Bolete, BSL coll. #2014-1027-1.

Pileus: 1.3–6 (9.5) cm wide when mature, uniformly to irregularly convex when developing, remaining convex or becoming broadly plane at maturity; **surface** dry to slightly moist, soft and very finely subvelutinous (minutely short subvelvety) when young, becoming more or less glabrous (not short velvety), from "Maroon" to "Burnt Sienna" to "Rood's Brown" to "Prussian Red" to "Hessian Brown" when young, becoming "Garnet Red" to "Morocco Red" to "Carmine" at maturity; uniform or more often with a slightly mottled appearance and sometimes showing the bright yellow context through cracks or irregularities in the cuticle; **margin** sometimes concolorous with the rest of the pileus but more often with a very narrow bright yellow band up to 1 mm wide which remains or may disappear at maturity; entire, uniform, and even or often irregular or lobed when mature, sometimes having a very narrow band or

Seattle Rosy Red bolete in dense clumps united at the base.

flap of sterile cap issue extending beyond the tubes, becoming uniformly entire and slightly upturned at maturity; **pileal context** up to 11 mm thick, "Pinard Yellow," unchanging when cut or bruised or with a very pale bluing reaction only slightly, irregularly and infrequently within 15 min. to an hour after disturbing the flesh; **odor and taste** mild (tasted raw) to faintly fungoid but leaving a very slight astringent taste afterwards for some time.

Tubes: 4–8 mm long at maturity, distinctly depressed at or before the stipe, pulling away from the stipe with maturity; "Reed Yellow" to "Primrose Yellow" to "Wax Yellow" at first, becoming "Olive-Ocher" at maturity; unchanging when cut or bruised or ever-so-slightly becoming irregularly pale blue next to the pileal context over time but not uniformly and barely noticeable; **pores** round to slightly elongate on most of the surface, 0.3–0.5 mm wide at first, distinctly elongated and short sub-lamellate directly next to the stipe, at maturity from 0.5–2.0 mm wide where round and up to 7 mm long where sub-lamellate next to the stipe; superficially, irregularly, and only slowly staining a dull reddish color where bruised on very mature basidiocarps.

Undersurface, Seattle Rosy Red Bolete, BSL coll. #2014-1029-1.

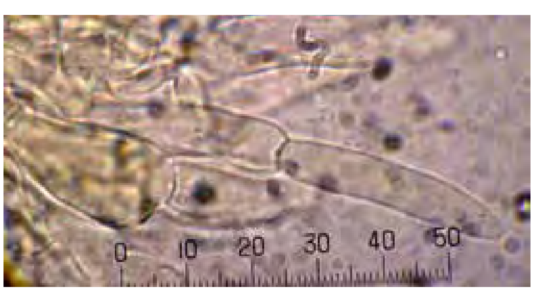
Part of BSL coll. #2014-117-1

Stipe: 1.5–5.5 (8) cm long, 0.4–2.3 (3.5) cm thick but averaging 0.7–2.0 cm thick, enlarged below and narrowing toward the pileus and from 0.4–1.3 (3.5) cm wide at point of attachment to the pileus; round in cross section overall, but some basidiocarps irregular and with the stipe widening apically and becoming somewhat flattened; color at first "Cinnamon Rufus" to "Tawny" to "Raw Sienna," becoming "Apricot Buff" to "Flesh Color" to "Sandford's Brown" and uniform or more often with yellowish tones interspersed and distinctly yellowish at the top where meeting the tubes; **surface** dry to moist, minutely appressed fibrillose, becoming glabrous with slight longitudinal striations sometimes evident and not reticulate, unchanging or darkening very slightly upon handling but not staining blue; **context** solid, more or less "Honey Yellow" in color, unchanging when cut or bruised or only slowly and slightly darkening over time on exposure, but not staining blue; **stipe base** abruptly narrowing and pointed where arising from the substrate and sometimes with a yellowish mycelium at this point.

Seattle Rosy Red Bolete uncut (left), freshly cut (center), and cut surface after waiting. Note lack of staining reaction. BSL coll. #2014-117-1.

Spore print: olivaceous brown, as "Light Brownish Olive"; the white paper that contacted the cap was stained "Olive Yellow."

Microstructures: Pileal surface a trichodermium of usually four (or more) cells, the basal cells shorter and wider, 27–42 × 13–15 µm, and the three apical cells elongated with the terminal cells 25–45 × 6–7 µm, cylindric or more often attenuating to a narrowed or slightly pointed to rounded tip; hyaline in KOH, thin walled, and smooth; **contextual hyphae** quite variable from 5–25 µm wide, thin walled, without clamp connections; **basidia** 40–46 × 11–14 µm, very uniform in size, clavate, hyaline, thin-walled, without a basal clamp connection, uniformly granular when mounted in 3% NH_4OH and with small to large guttules



Seattle Rosy Red Bolete at 1000× showing smooth trichodermial cells, BSL coll. #2014-117-1.

Seattle Rosy Red Bolete, dextrinoid basidiospores, 1000×, BSL coll. #2014-1027-1.

when mounted in Melzer's reagent; **sterigmata** mostly four (but some bi-sterigmate basidia were observed), up to 9 µm long; **basidiospores** variable in size and shape, 12–15 (17) × 5–6.5 µm, elliptical, fusiform-elliptic to cylindric-fusiform, slightly thick-walled, smooth (unornamented), pale brown in 3% NH_4OH, dextrinoid in Melzer's reagent. Microscopic feature not yet studied: tube trama tissue.

Macrochemical Reactions

Four parts of the mushroom were tested: pileus cuticle, pileus context with tubes attached, exterior of stipe, and stipe context.

$FeSO_4$ (ferrous sulfate, 10%): cap surface dark greenish-black after 15 min.; cap context color pale greenish after 15 min., and stipe surface and stipe context the same.

KOH (potassium hydroxide, 3%): all tissues becoming dull orange.

NH_4OH (ammonium hydroxide, 30%): negative.

PDAB (Ehrlich's reagent or 4-dimethyl aminobenzaldehyde): negative.

Habit and Habitat

Usually in dense subcespitose to cespitose clumps of several united at the base, less frequently single or gregarious. Associated with either *Betula pendula* or *Picea pungens*.

Mycophagy

For the Seattle Rosy Red Bolete I already noted above a slight astringent reaction in my mouth, upon tasting the cap tissue fresh. I also thinly sliced and sautéed a basidiocarp in Canola oil, so there would not be any added flavors or salt. It was firm, cooked down little, the flavor was good, it settled with me just fine and there was no unpleasant aftertaste. I'm pleased to report that the Seattle Rosy Red Bolete is perfectly edible.

Discussion and Comments

The following paragraphs compare the four related species mentioned above with the Seattle Rosy Red Bolete (refer to table).

Boletus campestris has darker cap colors, a uniform cap margin, stains strongly bluish or blue-green rapidly where cut or bruised, has smaller basidia, non-dextrinoid spores, a gregarious habit,

Table showing comparison of characteristics

	B. campestris [1]	*B. rubellus* [2]	*B. flavorubellus* [3]	*B. coccyginus* [4]	Seattle Rosy Red bolete
Pileus width	3-4 cm	3-8 cm	2.5-8 cm	2-4 cm	1.3-9.5 cm
Pileus color	rosy or pinkish red	dark red, red brown, blood red to "flame scarlet"	dark red brown	rosy red	bright rosy red
Cap margin color	uniform	bright yellow line	bright yellow line	uniform	narrow bright yellow line
Macrochemical Reactions	unknown	greenish in $FeSO_4$; flesh dull orange in KOH	unknown	unknown	greenish in $FeSO_4$; flesh dull orange in KOH
Staining blue	+	+	slowly stains blue	-, or faint	-, or faint
Trichodermial cells	roughened	some incrustation	some slight incrustation	roughened	smooth
Inflated trichoderm cells with amyloid contents	-	-	+	-	-
Trich. cells in KOH	bright yellow	unknown	yellow	dark yellow	hyaline
Basidia	26-38 x 10-14 µm	30-45 x 8-10 µm	20-24 x 8-10 µm	23-28 x 7-10 µm	40-46 x 11-14 µm
Spores	11-14(15) x 4.5-6 (7) µm	10-13 x 4-6 µm	10-13 x 4-5 x 4.5-7 µm	11.2-17.6 x 5.3-7 µm	12-15 (17) x 5-6.5 µm
Spores dextrinoid	-	-	-	+	+
Habit	gregarious	greg. to subcespitose	scattered	greg. to subcespitose	subcespitose to cespitose
Tree associations	unknown	hardwoods	unknown	conifers	birch or spruce
Distribution	east. N. America	east. N. Amer., Europe	east. N. America	California	Washington State

[1, 2, & 3] Some data taken from Thiers & Smith (1966) and Smith & Thiers (1971)

[4] Data taken from Thiers (1975)

and is known only from eastern North America. Macrochemical data and mycorrhizal associations for this species are unknown.

Boletus coccyginus, the other West Coast species, has a similar bright rosy red cap color, also lacks any noticeable staining, has similar sized spores that are dextrinoid, and has a similar subcespitose habit, but it's a much smaller mushroom, has a uniform cap margin lacking a narrow distinct bright yellow line, and has noticeably smaller basidia. Macrochemical data for this species are unknown. *Boletus coccyginus* is known only from a couple of specimens from California and was described by Thiers (1975). It's treated in the PNW Key Council Key to the Boletes in the PNW (Gibson & Bishop, 2011 revision) as well as in North American Boletes (Bessette et al., 2000) and is mentioned in *Mushrooms of the Pacific Northwest* (Ammirati & Trudell, 2009). At first I thought the Seattle Rosy Red Bolete was the same as this species, but closer examination revealed it differs in several characteristics, as mentioned above and in my chart. It's associated with conifers.

B. flavorubellus is about the same size as my Seattle Rosy Red Bolete and can have the same bright yellow color on the extreme cap margin, but otherwise most characteristics are different, as noted in the table. Both Thiers & Smith (1966) in their original description and Smith and Thiers (1971) give the spore measurements for *Boletus flavorubellus* as "10–13 × 4–5 × 4.5–7 µm" which is very unusual. I'm not sure if the third set of figures indicates additional sets of alternative spore widths or not and, if so, why didn't they include it as usual, giving one set of width measurements? Unfortunately, the authors didn't elaborate on this in either article.

B. rubellus has a similar size, a bright yellow cap margin, comparably sized basidia, identical macrochemical reactions, and a similar habit. However, it usually has a much darker cap color (except for var. *flammeus*), stains blue quickly where cut or bruised, has slightly smaller spores that are not dextrinoid, is associated with hardwoods, and is known only from eastern North America and Europe, not the Pacific Northwest. Breitenbach & Kranzlin (1991) describe the color of *B.* (*Xerocomus*) *rubellus* from Switzerland as "blood red" rather than a rosy red, which is in keeping with what's reported from N. American collections. *Boletus rubellus* would be a fairly close match to the Seattle Rosy Red Bolete if it had a bright rosy red cap and didn't stain blue. The same macrochemical reactions shared between these two species also indicates a close relationship.

Even though the overall pileal size in my Seattle collections is greater than those given for some of the other species, basidiocarp size is greatly influenced by immediate environmental or micro-climate conditions and thus can fluctuate. I suspect that in ideal conditions *Boletus coccyginus*, which is reported as being rather petite, would have a larger stature overall. For the Seattle Rosy Red Bolete, I found very small yet fully mature basidiocarps in clumps with much larger specimens, so these two species can be very similar (and variable) in size, based on conditions.

The pileal surface of the Seattle Rosy Red Bolete is composed of a trichodermium, but all these cells have smooth walls and did not stain yellow in 3% KOH. Thiers (1975) says that the cells of the trichodermium of *B. coccyginus* are "asperulate [finely ornamented] to faintly incrusted" and stain "dark yellow in KOH." For *B. campestris* Smith & Thiers (1971) state that the pileal surface cell walls are "smooth or roughened slightly." They basically say the same for *B. rubellus* and also that the cell contents are "lemon-yellow in KOH" for *B. campestris*. They also state that the trichodermial cells are "yellow" in KOH for *B. flavorubellus*.

Thiers (1975) noted the high degree of variability in spore size and shape for *B. coccyginus*, referring to them as "pleomorphic" because of the variable number of sterigmata formed on the basidia, also mentioned by him (the fewer the sterigmata, the larger the spores). The Seattle Rosy Red Bolete exhibits the same sterigmata and spore characteristics as *B. coccyginus*; I observed spores up to 19 × 6 µm, but they were seen so infrequently as not to be typical, and thus I did not include them in the spore dimensions given above. Smith & Thiers (1971) do not mention either a variation in number of basidial sterigmata nor a variable range of spore size and shape as being a feature of *B. campestris*, *B. flavorubellus*, or *B. rubellus*. Thiers (1975) says that the spores of *B. coccyginus* are "often dextrinoid," suggesting they may not always be, whereas Smith & Thiers (1971) state that *B. campestris* has spores with a "fleeting – amyloid reaction" and note a similar reaction for *B. rubellus*; they make no mention of the spores being dextrinoid for these species or *B. flavorubellus*. The dextrinoid reaction of the spores in the Seattle Rosy Red Bolete is bvious but not strong.

The mycorrhizal tree symbiont for the Seattle collections could be either *Betula pendula* (European White Birch) or *Picea pungens* (Colorado Blue Spruce) but is not likely to be both. Both trees were mature and were close enough, and the topography was conducive enough, for either of their roots to spread and be the primary mycorrhizal associate. I found specimens very near the birch as well as directly under the spruce. The European White Birch has one of the widest distribution ranges of any tree in the Northern Hemisphere, from western Europe all the way east across Asia to the Pacific Ocean in Siberia, but it's not native to North America. The Colorado Blue Spruce is not native to Washington State, but it is found in SE Idaho and throughout the Rocky Mountains. There are no records of any of these four related mushroom species from the natural distribution area for this spruce in the Rocky Mountains. Refer to the table for known mycorrhizal hosts for the related species.

Conclusion

So, where does that leave us? The features I've documented clearly demonstrate that these specimens from Seattle are similar to four other species but differ in several characteristics and thus appear to be a unique species (see table). So for the time being I'm calling these recently found collections my Seattle Rosy Red Bolete. It's very distinctive with its stunning and remarkable red color. There's really nothing else quite like it here in Washington State that I've ever seen before, and I've been studying the fungi here since 1970.

If you're reading the hard copy of *Spore Prints*, which is in black and white, please refer to this article online at www.psms.org to see what these mushrooms look like in color.

Acknowledgement

Special thanks to Laurie M. for bringing this strikingly beautiful fungus to my attention and allowing me to make additional collections.

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all photos by Brian S. Luther