# SPORE PRINTS

**BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY**
**Number 522** **May 2016**

## INSIDE THE CATERPILLAR FUNGUS FARM IN SAIGON

http://english.vietnamnet.vn/, April 17, 2016

The HQGANO caterpillar fungus farm in Binh Tan District, Ho Chi Minh City, regularly holds free tours for visitors to learn about the process of growing caterpillar fungus.

In English, it's called caterpillar fungus. But it's better known throughout Asia by the Tibetan term *yartsa gunbu*, which means "summer grass, winter worm."

This fungus (*Cordyceps sinensis*) makes its living by getting inside a host insect and ultimately killing and consuming it. In this case, the insect that's invaded is the caterpillar of the ghost moth. This pinky-sized mummified caterpillar is the most expensive fungus in the world.

It is known as a medicinal mushroom, and its use has a long history in traditional Chinese medicine. The hand-collected fungus/caterpillar combination is valued by herbalists as a status symbol; it is used as an aphrodisiac and treatment for ailments such as fatigue and cancer, although such use is mainly based on traditional Chinese medicine and anecdotal evidence.

In the world, caterpillar fungi exploited in the wild are extremely rare, mainly at an altitude of 3,200 meters in the Himalayas and Tibet. Each year the output is only 80 kg, so the price is very high, from $60,000 to $80,000 per kilo.

Some farms in Vietnam are now able to produce caterpillar fungi in an artificial environment, including the 700 sq. m farm in HCM City.

In the first step, red brown rice is poured into sterilized glass jars. Next, the jars are filled with a mixture of silkworm pupa powder and soy germ extract. A sufficient amount of coconut juice is then poured into the jar. After being sealed, the jars are sterilized for 30 minutes, time enough to ensure the mixture is sterile while still retaining the nutrients needed to grow fungi.

*Adding red brown rice.*

Next, the fungus is implanted into the jar. This is one of the most important stages, which requires high expertise of technicians.

*Implanting fungus under sterile conditions.*

This process requires a closed, sterile room environment to ensure that the products are not contaminated.

The jars are then sealed and placed in cold rooms. A room of about 6 sq. m equipped with air conditioning, temperature and humidity control, and automatic light is enough to cultivate 2,000–3,000 jars of fungi. During the cultivation time, technicians regularly check to eliminate defective products damaged by mildew. If fungi jars are well cared for, the success rate is up to 99%.

After 55–60 days in the cold room, fungus develops fully and is ready for harvest. On average 1,000 jars will produce approximately 20–25 kg of fresh fungi. The long fibers have the best quality and will be sold at a high price. The remaining parts are used to process other products such as fungi tea bags and biomass powder.

*Sorting.*

After being sorted, the fungi are dried and sterilized by UV light and ozone and packaged for sale.

The farm's director, Duong Van Thiet, said in the past three months, the farm earned more than VND3 billion (US $134,700) in revenue and had a profit margin of about 15 percent.

*If low sex drive is making us blue,*
*We invest in some yartsa gunbu*
*That's found just in Tibet,*
*Though there's zero proof yet*
*Of what* Cordyceps sinensis *can do.*

*—MikeAq, OEDILF*

## MEMBERSHIP CHAIR NEEDED

**Kim Traverse**

Membership Chair Ann Polin has decided she needs to step down soon owing to increasing family obligations that require more of her time and energy. She hopes that we can find a replacement soon, so she will be able to train that person and make the transition easy for everyone.

Ann has been Membership Chair for quite a number of years now and brought PSMS membership into the digital age as well as being the face of membership and the prompt responder to all queries regarding membership. I remember one year Ann flew in from West Africa late one evening and was at the Fall Show the next morning, sitting at the membership table when we opened to the public! She has done a fabulous job for PSMS and deserves our praise and heartfelt thanks!

Membership isn't a mere detail of the organization—it is the structural network (think mycelium!) that connects every part of the Puget Sound Mycological Society and out to the larger world. The Chair manages new members and longtime members, interfaces with our website host and listservers, and works with the Board to always improve operations.

If you are interested in this position, please contact me in person or at president@psms.org.

# 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

OFFICERS: Kim Traverse, President[2015–2017]
*president@psms.org* (206) 380-3222
Daniel Winkler, Vice President[2016–2018]
*me@danielwinkler.com* (425)-822-5080
John Goldman, Treasurer[2016–2018]
*treasurer@psms.org* (206) 933-0838
Luise Asif, Secretary[2015–2017]
*asiff.luise@yahoo.com* (206) 364-6741

TRUSTEES: 2016–2017:
Sweta Agrawal, Paul Hill, Donna Naruo, James Nowak, Alyssa Panning

2015–2017:
James Ardena, Carlos Cruz, Brady Raymond, Erin Raymond, Milton Tam

ALTERNATES: Shannon Adams, Anne Tarver

IM. PAST PRES: Marian Maxwell

SCI. ADVISOR: Dr. Steve Trudell

EDITOR: Agnes A. Sieger, 271 Harmony Lane, Port Angeles, WA 98362
*sieger@att.net*


## CALENDAR

| | |
|---|---|
| May 7 | Field trip (see website) |
| May 10 | Membership meeting, 7:30 pm, **Graham Visitor Center at the Arboretum** (see website) |
| May 14 | Field trip (see website) |
| May 16 | Board meeting, 7:30 pm, CUH board room |
| May 17 | *Spore Prints* deadline |
| May 20 | Field trip (see website) |
| May 22 | Mushroom Maynia, 10 am–4 pm, CUH |
| May 27 | Field trip (see website) |
| June 4 | Field trip (see website |
| **June 7** | Membership meeting, 7:30 pm, CUH |

## BOARD NEWS

**Luise Asif**

**IMPORTANT CHANGES:** To accommodate CUH, the **May 10 Membership Meeting** will be held at the Graham Visitor Center at the Arboretum. Address and map will be posted on the PSMS website. The **June Membership meeting** is back at CUH but on the *first* Tuesday, June 7.

New board members Sweta Agrawal and Alyson Panning and alternates Shannon Adams and Anne Tarver were welcomed to their first meeting. Welcome and thank you for your enthusiasm. At the forefront of the Board's focus at this time are Mushroom Maynia, Sunday, May 22; the All Sound Ben Woo Foray, October 21–23/2016, and this fall's annual PSMS Wild Mushroom Show.

## MEMBERSHIP MEETING

Tuesday, May 10, 2016, at 7:30 pm at the Graham Visitor Center at the Arboretum

*Anna Bazzicalupo*

Our speaker for May is Anna Bazzicalupo, MSc, and her talk is titled "Ben Woo's *Russula* Collection— A Lay Mycologist's Contribution to Science."

*Russula* is a genus of mushrooms that is found all over the world and that is notoriously difficult to identify to species. Ben Woo, an expert amateur, was a founding member of the Pacific Northwest Key Council and a founder and the first president of PSMS. For over 30 years, he carefully sampled and documented over 1000 specimens of *Russula* from the Pacific Northwest.

To help resolve Western North American *Russula* species, Anna and colleagues from the University of British Columbia in Vancouver, B.C., analyzed Woo's collection to gain a better understanding of the variation in genetics and field characters among the species. The study matched DNA sequences of specimens to species in Europe, species described from the Pacific Northwest, and species that were potentially new to science. Among other things, Anna will show how two of the three species of *Russula* with a shrimp odor (one new to science and all highly variable in appearance) can sometimes be distinguished. Do all three species taste the same? Should one be prized above the others for the table? She'll be looking forward to your conclusions about which is best in butter.

Anna Bazzicalupo is a PhD student in Mary Berbee's lab at the University of British Columbia, Vancouver, who works on *Russula*s of the Pacific Northwest. Anna grew up in Naples, Italy. She did her undergrad degree in Biology at the University of Aberdeen in Scotland and her Masters at the Royal Botanic Garden in Edinburgh, where her interest in fungi blossomed.

To augment Anna's talk, Ron Post will offer a short introduction on Ben Woo.

Will people with last names beginning with the letters L–Z please bring a plate of refreshments to share after the meeting.

## OKANOGAN-WENATCHEE NATIONAL FOREST ANNOUNCES CHANGES TO SPRING MUSHROOM COLLECTION PROGRAM

**Mick Mueller,**
**Okanogan-Wenatchee NF and PSMS member**

The Okanogan-Wenatchee National Forest (NF) has changed some of its policies and regulations concerning collection of mushrooms this spring (2016).

**Background:** After two years of significant burns on national forest land in Chelan and Okanogan counties (nearly 136,000 acres in 2014 and almost 175,000 in 2015), there has been intense interest in morel picking in the subsequent years.

In 2015, exclusive commercial and recreational picking areas were designated as well as camping areas explicitly for the use of commercial pickers. This was done in an attempt to minimize potential or perceived user conflicts in the pursuit of morel picking

in these large but finite areas. While the concept of designated camping with provided trash and sanitation facilities did seem to avoid or minimize the potential for resource damage from otherwise large, dispersed camps, there was a lot of discussion and disagreement on the use of exclusive picking areas and their utility, value, and efficacy from commercial and recreational pickers and law enforcement officials. As a result, several changes were made in the rules for picking special forest products/mushrooms in the Okanogan-Wenatchee NF for 2016.

One change which will likely make most PSMS members and recreational pickers in general happy, is that the Forest Service has increased the personal use limit for possession and transport of mushrooms to five gallons total (all species in possession) per person per day from three gallons. Again this is for personal use. If you plan to sell or harvest more than this amount per day, you'll need to buy a commercial permit.

A second change will be that *EVERYONE* will need to have a either a commercial use permit or the new Incidental Use Mushroom Information Sheet (a type of recreational use permit). These non-commercial sheets are available online from the Forest Service webpage at http://www.fs.usda.gov/main/ okawen and are free. See "mushroom harvesting" links on that page.

**Commercial Permits:** To get a commercial permit, you must go, in person, to a ranger district office or supervisor's office, Monday through Friday, 8:00 a.m. to 4:30 p.m. Commercial mushroom permit fees are $30 for a 2-day permit, $80 for a 30-day permit, or $100 per season. Seasonal permits are valid April 18 through July 31, 2016. More information is available on the Forest Service website listed above including maps of the fire areas. As is always asked, "What if I don't get a permit, what's the fine?" The fine for collecting special forest products without or in violation of a special use permit is $200 or MA. That is, it is up to the forest officer's discretion to write a $200 ticket or issue a mandatory appearance in federal district court (eastern WA). Penalties imposed by a judge can range up to $5000 and/or six months in jail.

## FUNGUS DISCRIMINATES AMONG OFFSPRING OF GENETICALLY IDENTICAL ASEXUAL SPORES BEFORE FUSING

**http://sptnkne.ws/bc7y**, April 15, 2016

Scientists at the University of California, Berkeley have shown that a fungus called *Neurospora crassa* identifies the genes it has in common with potential mates and then preferentially helps or hinders them.

"While kin recognition is important in animals, microbes often use kind recognition, in which cells are genetically related only at certain loci—so-called 'greenbeard' genes," the authors wrote in their study, published on Thursday [April 14] in the journal *PLoS Biology*.

The "green-beard effect" was named by evolutionary biologist Richard Dawkins in his book *The Selfish Gene*, in which he explains the hypothesis, which is a model for the evolution of selective altruism.

"I have a green beard and I will be altruistic to anyone else with green beard," Dawkins wrote.

The hypothesis requires that organisms acquire three things: an arbitrary peculiarity, or "green beard," the ability to detect the green beard on others, and the tendency to treat such green-bearded individuals preferentially.

In their study, the scientists examined how genetically identical asexual spores of *Neurospora crassa* germinate, and undergo chemotropic interactions and eventual cell fusion.

"These genetically identical cells undergo a dialog, alternately 'listening' and 'speaking,' which is essential for chemotropic interactions," explained lead author Professor N. Louise Glass.

The scientists compared the communication of genetically different "germlings," the organism produced by germination of an algal or fungal spore. They made the surprising finding that *Neurospora crassa* populations fall into distinct communication groups.

"It seems like all strains speak the same basic fungal language, but due to different dialects, some strains cannot understand each other, and therefore are unable to establish communication necessary for cell fusion," explained Dr. Jens Heller, first author of the study.

"Since we know that programmed cell death can result from fusion of incompatible partners in *N. crassa*, choosing the right partner at a distance can be important," Heller said.

Germlings from different communication groups grew past each other to find a germling of their own communication type for cell fusion, which allows them to more rapidly establish a colony of fungi.

"Our findings reveal a heretofore under-appreciated complexity in fungal communication. We have only scratched the surface on communication and interactions of these enigmatic organisms," Professor Glass said.

## GENE-EDITED MUSHROOM ESCAPES U.S. REGULATION

**Emily Waltz**

http://www.nature.com/, April 2016

The US Department of Agriculture (USDA) will not regulate a mushroom genetically modified with the gene-editing tool CRISPR–Cas9.

The long-awaited decision means that the mushroom can be cultivated and sold without passing through the agency's regulatory process—making it the first CRISPR-edited organism to receive a green light from the U.S. government.

Yinong Yang, a plant pathologist at Pennsylvania State University in University Park, engineered the common white button (*Agaricus bisporus*) mushroom to resist browning. The effect is achieved by targeting the family of genes that encodes polyphenol oxidase (PPO)—an enzyme that causes browning. By deleting just a handful of base pairs in the mushroom's genome, Yang knocked out one of six PPO genes—reducing the enzyme's activity by 30 percent.

Yang's mushroom did not trigger USDA oversight because it does not contain foreign DNA from "plant pests" such as viruses or bacteria.

*White button mushrooms.*

## FUNGUS-ILLUSTRATED STAMPS FROM THE ISLE OF MAN

**Brian S. Luther**

The Isle of Man is in the middle of the Irish Sea off the west coast of Britain and is technically not part of Great Britain, but rather is a self-governed British Crown Dependency, with the head of state being the reigning British monarch. It has an interesting history, which you might enjoy reading about online and has been inhabited by humans for over 8,000 years. The capital is Douglas. The symbol on their red flag and shield is the peculiar three legged *triskelion*, also called the Three Legs of Man. Manx (noun) is Gaelic for the Isle of Man and the native language, and the adjective Manx refers to all things related to the Isle of Man, such as the unique Manx Loaghtan Sheep, Manx Cat, etc.

The Isle of Man issues its own postage, which is recognized as official by international philatelic catalogs.

The following table lists Manx stamps featuring fungi. All catalog numbers are from the Scott Postage Stamp Catalogues; M = mushrooms or fungi as the main illustration; MID = mushrooms or fungi in the design of the illustration, background or border but not the primary illustration; s/s = souvenir sheet; FDC = first day cover, an envelope (cover) with the stamps cancelled on the first day of issue, along with a cover illustration called a cachet.

*Isle of Man Mycophilatelics*

| *Issue Date* | *Cat. #* | *Value* | *Type* | *Species or Subject* |
|---|---|---|---|---|
| 9/1/1995 | 650 | 20 p | M | *Amanita muscaria* |
| " | 651 | 24 p | " | *Boletus edulis* |
| " | 652 | 30 p | " | *Coprinus disseminatus* |
| " | 653 | 35 p | " | *Pleurotus ostreatus* |
| " | 654 | 45 p | " | *Geastrum triplex* |
| " | 655 s/s | £1 | " | "Shaggy ink cap," *Coprinus comatus* |
| 10/1/2008 | 1286 | 50 p | M | *Piptoporus betulinus* |
| 10/20/2008 | 1293 | 50 p | MID | Mushroom house |

**Comments**

The first five stamps in the 1995 set are labelled with scientific names only, but the stamp on the s/s has just the common name "Shaggy ink cap." This s/s is also labeled Singapore World Stamp Exhibition (Sept. 1–10, 1995), so the release of this set coincided with that event. There are two FDCs for this set: the five stamps (Scott 650–54) are on one, and there's a separate FDC with only the s/s on it (Scott 655). Both have the same stylized bolete cancel and the same cachet that says "fungi" and show buttons and mature mushrooms with mycelium or rhizomorphs arising from each.

Brian S. Luther

*Scott 650–654.*

Brian S. Luther

*Scott 655 souvenir sheet.*

Brian S. Luther

*Isle of Man FDC (one of two).*

Scott 1286 is part of a six stamp set titled "A walk in the Ballaugh Curragh," which is a natural area on the island. This stamp is labelled "Birch Bracket Fungus • Piptoporus betulinus" and also has the Manx Gaelic common name for the fungus. This is an interesting polypore and another article to consult relating to this fungus is titled "The Mighty Birch Polypore, King of the Bracket Fungi" (*Spore Prints 508*, January 2015, p. 3). This same fungus was found in a pouch (along with another polypore) carried by Otzi the Ice Man, whose mummified 5,000 year old body was discovered in 1991 high in the Tyrolean Alps, just barely inside Italy (very close to the border with Austria) and is currently on display in the South Tyrol Museum of Archeology in Bolzano, Italy.

Brian S. Luther

*Scott 1286.*

Scott 1293 is a stamp I recently found after studying Isle of Man stamps in detail. It's part of a six value set called "The Jolly

Christmas Postman," On this stamp there's a mushroom house in the form of a stylized *Amanita muscaria* in a Christmas toy town scene, showing the legs and boots of the postman walking by.


Brian S. Luther

*Scott 1293.*

If you're interested in reading about mycopostal items issued from Great Britain or the British territory of the Falkland Islands, then please consult Luther (2015a & 2015b).

**References**

Luther, Brian S. 2015a. Fungus-Illustrated Stamps from Great Britain (excluding British Crown dependencies, territories, possessions, etc.). *Spore Prints 511* (April), pp. 4–6. Online and in color at www.psms.org and also on this website under "Education."

Luther, Brian S. 2015b. Falkland Islands Mycostamps. *Spore Prints 514* (September), pp. 4–5. Online and in color at www.psms.org.

## CAN MAGIC MUSHROOMS EASE THE PAIN OF REJECTION?

**Rachel Feltman**

*The Washington Post*, April 19, 2016

Hallucinogenic drugs obviously have their supporters: Just look to the 1970s. But a growing body of research suggests that these kinds of drugs might do some actual good, especially for those suffering from depression or anxiety. The latest study to test psilocybin—the psychedelic compound that gives so-called "magic mushrooms" their kick—indicates that it might dull the negative effects of being excluded from social situations.

The results, published Monday in the *Proceedings of the National Academy of Sciences*, don't necessarily mean you should fight off fear of missing out with a hallucinogenic trip. But they could help researchers develop new therapies for social anxiety.

Psilocybin is actually being used in several clinical trials, so it could indeed be used to treat depression in the near future. Lead researcher Katrin Preller of the University Hospital of Psychiatry Zurich explained that psilocybin has much more specific targets than antidepressants currently on the market: It pretty much targets only two specific brain receptors. That makes it easier to get a handle on how it works and who it should help, at least in theory.

It also means that scientists can use it to see how those specific brain receptors change behavior.

Preller and her colleagues wanted to see what the psilocybin-associated receptors could do for something called "social pain," which is exactly what it sounds like—the pain associated with rejection. They triggered it in their 21 study subjects by creating a computer game where a virtual game of catch was played with two other players who increasingly excluded them from the activity. Meanwhile, subjects' brain activity was being scanned.

The study subjects played this game under the influence of either a small dose of psilocybin or a placebo pill, then filled out a survey. Their responses showed that they were aware of being excluded on both occasions—they weren't too high to notice that the ball wasn't coming their way. But when they took the psilocybin, in addition to an increased sense of "unity" commonly reported in hallucinogenic trials, they indicated fewer signs of social pain.

It's too small of a study to draw any strong conclusions from, and the participants were all healthy—they didn't actually suffer from severe social anxiety or depression. But Preller thinks her team has taken a step toward uncovering the mechanism behind a possible treatment.

"It seems like by stimulating these two receptors, serotonin 1A and serotonin 2A, psilocybin is acting on brain areas which are responsible for our feeling of social pain—the dorsal anterior cingulate cortex. Furthermore, we showed that another neurotransmitter, aspartate, seems to be involved as well," Preller said. Serotonin is a chemical that relays signals between different parts of the brain, and many scientists believe that a disruption in this process can cause depression or anxiety. It's possible that psilocybin—or drugs inspired by it—could target these problems more directly than antidepressants currently on the market.

"It might be possible to develop new medication targeting these specific mechanisms," Preller said. "In general, new treatments for psychiatric disorders are rare, and there is still a great need for improvement."

## WHEN POSSIBLE, PLANTS NEGOTIATE A BETTER DEAL WITH COOPERATING FUNGI

**Brooks Hays**

http://www.upi.com/Science_News/, April 14, 2016

ZURICH, Switzerland, April 14 (UPI) - It appears plants have a basic understanding of microeconomics. When faced with two fungi, one cooperating more and the other less, plants will offer more resources to the most cooperative fungus until the other starts sharing more nutrients.

Many plants rely on fungi to retrieve deep-lying nutrients and deliver them to their roots. In exchange for phosphates, the plant trades carbohydrates. Sometimes, a frugal fungus will offer a stingier rate of exchange.

Researchers in Switzerland presented plants with varying numbers of fungal partners to learn more about plants' decision making.

As the team of scientists found out, a plant without any other fungal trading partners has no recourse against a hard-bargaining fungus. But when a more generous fungus is also doing business with the plant, the market dynamics change.

"The plant exploits the competitive situation of the two fungi in a targeted manner, triggering what is essentially a market-based process determined by cost and performance," Andres Wiemken, an environmental scientist at the University of Basel, explained in a news release.

## RESUPINATE FUNGUS OF THE MONTH: The Genus *Crustomyces* ©Brian S. Luther

The genus *Crustomyces* was proposed by Walter Julich (1978), based on *Odontia subabrupta*, which was originally described by Bourdot & Galzin (1928). *Crustomyces subabruptus* is very similar to what Schweinitz (1832) had described 96 years earlier in eastern North America as *Radulum pini-canadensis*. Overholts (1930) then transferred *R. pini-canadensis* to the genus *Peniophora*. It was next transferred into the genus *Corticium* by Rogers & Jackson (1943), then into *Cystostereum* by Parmasto (1968), and finally into *Crustomyces* by Julich (1978). The genus is widespread, and there are currently six recognized species worldwide, with two being found in North America: *C. pini-canadensis* and *C. subabruptus*.

This article focuses on one of the many resupinate fungi collected during my on-going research project studying these fungi from Cypress Island, WA. I began this study in 2011 with the approval of the WA State Dept. of Natural Resources (DNR). All colors in quotes are from Ridgway (1912).

**Description of Collections**

*Crustomyces subabruptus* (Bourd. & Galz.) Julich

BSL coll. #2011-928-18

On well decayed bark of Douglas Fir (*Pseudotsuga menziesii*) easily removed from log sections cut years earlier, in mixed conifer forest. Trail going to Reef Point from Cypress Mainline trail, Cypress Island, Skagit Co., WA. September 28, 2011.

BSL coll. #2014-1112-5.

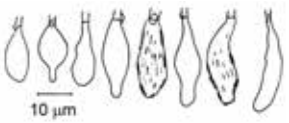
On a very firm but dead and decaying Madrone (*Arbutus menziesii*) limb on the ground in deep conifer duff, in a conifer forest of predominantly Douglas Fir (*Pseudotsuga menziesii*), with some Western Hemlock (*Tsuga heterophylla*), Western Red Cedar (*Thuja plicata*), and Western Yew (*Taxus brevifolia*) mixed in. Trail from Cypress Head to Bradberry Lake, Cypress Island, Skagit Co., WA. November 12, 2014.


*BSL coll. #2011-928-18.*


*BSL coll. #2014-1112-5.*

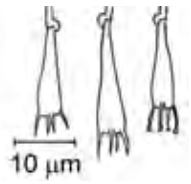
**Basidiocarp:** Resupinate, covering several square centimeters, 2–2.5 mm thick; color when fresh mostly a bright whitish to a slightly dirty bright whitish, or infrequently with some scattered areas with irregular very pale brownish casts, or it can also be a warm very light tan ("Cartridge Buff") but upon drying becoming much darker ("Light Drab" to "Drab") but paler in the contextual cracks; texture hard and brittle (both fresh and dried), very firmly attached to the substrate and not easily removed intact; *hymenophore* strongly odontioid (having fine pointed projections called teeth); teeth varying from irregularly cylindrical to subcylindrical to conical, forming in small clusters of several as viewed under the dissecting microscope, with the mature teeth projecting from 1–2 mm and each tooth with a distinct little tussock of mycelial hair protruding at the apex, especially noticeable under higher magnification, with all teeth forming in a positive geotropic orientation (downward pointing with the basidiocarp growing underneath the woody substrate); *margin* normally very abrupt and nondescript in mature specimens but lighter in color or white byssoid (cottony) diffuse when immature, usually with immature teeth forming close to the edge (if not cottony), but some scattered areas may have a noticeable toothless edge a few millimeters wide.

**Microstructures:** *Hyphal system* dimitic; generative and hymenial hyphae up to 2.5 µm wide but usually narrower, hyaline, thin-walled, with clamp connections; skeletal hyphae very fine, 2–3 µm wide, hyaline, thick walled, lacking clamp connections, scattered, but most abundant in the subicular layer next to the substrate; crystalline matter common throughout; apical teeth hyphae irregular, contorted, and slightly thick walled or incrusted. *Gloeocystidia* 17–25 × 6–10 µm, varying from clavate at first, becoming irregularly clavate to ventricose-rostrate (enlarged below with a narrower apex), to fusoid-ventricose (enlarged in the middle and narrowing toward the ends), mostly thin walled, but some slightly incrusted, common in the hymenium, with a basal clamp connection, staining lightly in Phloxine, but sulfo-benzaldehyde negative. *Dendrohyphidia* up to 1.5 µm wide, but length not easy to determine because the cells cannot be isolated, but some measured up to 15–20 µm long, with irregular branching toward the apex, mixed with basidia in the hymenium and somewhat difficult to find. *Basidia* 13–18 × 4–4.5 µm, clavate, thin walled with a basal clamp, with four sterigmata up to 4 µm long. *Basidiospores* 4–5 × 2.5–3 µm, ellipsoid, hyaline, thin-walled. smooth, and inamyloid.

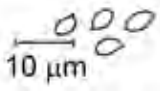



*Gloeocystidia, with some incrustation.*


*Dendrohyphidia.*




*Basidia.*




*Basidiospores.*

**Discussion**

Eriksson & Ryvarden (1975) give the teeth on this species as being "generally ab. 0,5 mm long," but as you can see from the description of the 2011 and 2014 collections above, the teeth can get to 2 mm, although they're usually shorter.

Infrequently the gloeocystidia in the 2014 collection were observed to have some refractive incrustation on the cells, which I found no previous reports of in the literature.

As pointed out by Eriksson & Ryvarden (1975), the number of dendrohyphidia present can vary considerably from collection to collection. They can be common or abundant in some specimens but also may be rare and difficult to find, or seemingly not present, in others. In the collections described here, the dendrohyphidia are infrequent, but careful observation reveals their presence.

Chamuris (1986) did an extensive study of these fungi in North America, including growing cultures and doing mating studies. He placed them in the genus *Cystostereum* at the time, but apparently failed to realize that Julich (1978) had already transferred these to the genus *Crustomyces* eight years earlier, since he makes no mention of this genus nor of Julich's publication. According to his research at the time, there were two morphologically distinct subspecies based on its occurrence in either eastern or western North America. The eastern subspecies is *C. pini-canadensi*s and it has either a smooth basidiocarp or is slightly tuberculate or sub-odontioid at most. The western form was recognized mostly as subspecies *C. subabruptus* and typically is odontioid or hydnoid having distinct tooth-like projections covering the fertile portion of the basidiocarp. Ginns & Lefebvre (1993) transferred subspecies *subabruptus* to *Crustomyces*. According to the CortBase website, these two subspecies are now recognized as distinct species: *Crustomyces subabruptus* (Bourdot & Galzin) Julich, known from Europe and North America, and *C. pini-canadensis* (Schw.) Julich, known only from North America. Ginns & Lefebvre (1993) list both species (which they treated as subspecies at the time) as having been found in Washington State. Eriksson & Ryvarden (1975) have an excellent treatment of this species with a detailed description, line drawings, and a black and white photo, but under *Cystostereum subabruptum*. Breitenbach & Kranzlin (1986) provide a description, line drawings, and a color photo of *Crustomyces subabruptus*. Bernicchia & Gorjón (2010) also have a description of this species along with three color photos.

For Europe Breitenbach & Kranzlin (1986) state that *Crustomyces subabruptus* is found on conifer substrates in Switzerland, but Bernicchia & Gorjón (2010) list it as only occurring on hardwoods, and Eriksson & Ryvarden (1975) say it's found on both hardwoods and conifers. In North America, Ginns & Lefebvre (1993) list both hardwood and conifer hosts for this species, and my collections discussed here confirm this.

A DNA study by Larsson (2007) tentatively placed *Crustomyces* in the Cystostereaceae, but had a question mark after the family.

**Classification Hierarchy**

Kingdom Fungi (Mycota)
Division Basidiomycota
Class Agaricomycetes
Order Polyporales
Family Cystostereaceae
Genus Crustomyces

**References**


Bernicchia, A. & S. P. Gorjón. 2010. *Fungi Europaei.* Vol. 12. *Corticiaceae s.l.* Edizioni Candusso, Alassio, Italy. 1008 pp. + 427 color plates.

Bourdot, H. & A. Galzin. 1928. Hymenomycetes de France. Lechevalier, Paris. 764 pp.

Breitenbach, J. & F. Kranzlin. 1986. *Fungi of Switzerland,* Vol. 2. *Non-gilled fungi*. Verlag Mykologia, Lucerne. 412 pp.

Chamuris, George P. 1986. The *Cystostereum pini-canadense* complex in North America. *Mycologia 78*(3): 380–390.

Eriksson, John & Leif Ryvarden. 1975. The Corticiaceae of North Europe. Vol. 3 - Coronicium - Hyphoderma. *Fungiflora*, Oslo. pp. 287–546.

Ginns, J. & M. N. L. Lefebvre. 1993. Lignicolous Corticioid Fungi (Basidiomycota) of North America. *Mycologia Memoir No. 19*. APS Press, St. Louis. 247 pp.

Julich, Walter. 1978. Studies in resupinate Basidiomycetes - V. Some new genera and species. *Persoonia 10*(1): 137–140.

Larsson, Karl-Henrik. 2007. Re-thinking the classification of corticioid fungi. *Mycol. Res. 111*: 1040–1063.

Overholts, L. O. 1930. Mycological notes for 1928–1929. *Mycologia 22*(5): 232–246.

Parmasto, Erast. 1968. *Conspectus Systematis Corticiacearum.* Tartu, 261 pp.

Ridgway, Robert. 1912. Color Standards and Color Nomenclature. Privately published by the author, WA, D.C., 43 pp. & 53 color plates.

Rogers, D. P. & H. S. Jackson. 1943. Notes on the synonymy of some North American Thelephoraceae and other resupinates. *Farlowia 1*: 263–328.

Schweinitz, L. 1832. Synopsis fungorum in American Boreali media degentium. Secundum observations Ludovici Davidis de Schweinitz. *Trans. Amer. Philos. Soc. 4*(2): 141–316.


## May is Morel Month!

### MUSHROOM MAYNIA

**Milton Tam**

PSMS is sponsoring Mushroom Maynia, our spring mushroom event, on May 22, 2016, from 10 am to 4 pm at the UW Botanical Garden's Center for Urban Horticulture at 3501 NE 41st Street in Seattle. Admission is $3 for an individual or $5 for a family. We encourage families with children (of all ages) to attend as we are trying to kindle an interest in mushrooms in everyone. We are planning a big 3-ring circus, but with a mushroom theme. For example, you can make your own oyster mushroom growing kit, taste a variety of choice edible mushrooms, tour educational exhibits, use mushroom pigments to dye scarves, attend lectures on mushrooms, see a mushroom puppet show, make a mushroom hat, use mushroom crayons in coloring books, and top it all off by having a mushroom painted on your face. Bring in any mushrooms you happen to find. Experts will be on hand to identify them!

## REVISITING CALIFORNIA'S DEADLIEST WEEK OF MUSHROOM POISONINGS: 19 DEAD AND 27 HOSPITALIZED

**George Caughey**

*Mycena News*, Myco. Soc. San Francisco, March 2016

[abridged] The week beginning February 26, 1934, included possibly the single deadliest mushroom meal recorded in the Americas, and is momentous in the annals of poisoning by fungi by any standard. At this point, few now living can have experienced these events first hand. Curiously, this tragic week is seldom referenced or mentioned. Indeed, I have yet to encounter a member of the MSSF, a medical colleague, or a toxicologist who knows of it. This is unfortunate, not only because of the disaster's sobering dimensions, but because of the lost opportunity to learn how to prevent and respond to similar events.

Of several independent "toadstool poisonings" reported in California 82 years ago at the beginning of the month of March, by far the most significant was a mushroom dinner on a coastal lettuce ranch 3 miles south of Arroyo Grande near San Luis Obispo. After the meal, 24 individuals were hospitalized and 16 died. The fungi were foraged by Filipino farm workers, who were described as being delighted by their discovery of mushrooms emerging in the wooded hills near the fields after a series of rains. They invited the two owners of the ranch to share the feast. Although sickened and hospitalized, their employers survived. These events follow patterns repeated several times in the later 20th and early 21st centuries: an immigrant group picking fungi with which they are unfamiliar. The mushrooms foraged in this instance remain unidentified.

In terms of fatalities, the Arroyo Grande feast may have been the single most significant mushroom poisoning event in the history of California, and also of the rest of the Americas and Europe. Although it is certainly the case that some deaths from fungal ingestion go unattributed, unrecognized, or unreported, it is unlikely that a cluster of poisonings involving so many individuals would fail to be linked to fungi and reported by the press. If others know of more significant events, I would like to hear of them.

Additional California victims of toadstool toxins appeared elsewhere during the same week, as reported in newspaper accounts of the time. These victims included two children, ages 3 and 5, who were hospitalized in Salinas after consuming fungi from Monterey County near Pacific Grove. Their parents, who may have picked and prepared the fungi, also were hospitalized, and apparently survived. In a separate event, an adult woman from Tulare County died in Woodlake Hospital 5 days after consuming foraged mushrooms. In total, 19 fatalities attributed to ingestion of toxic fungi were recorded during this one week. An additional death occurred March 8th, 3 days after eating wild mushrooms picked on a grape ranch in Sierra Madre, near Pasadena. Thus, at



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

RETURN SERVICE REQUESTED

Non-Profit Org.
U.S. POSTAGE
**PAID**
SEATTLE, WA
PERMIT NO. 6545