SPORE PRINTS

BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY
Number 603 June 2024

THE STUNTZ FOUNDATION, UW HERBARIUM, AND DANIEL E. STUNTZ AND PATRICE G. BENSON ENDOWED MYCOLOGY FUND

Joanne Young, The Stuntz Foundation, David Giblin, UW Herbarium Collections Manager

Dr. Daniel E. Stuntz, UW Professor of Botany and Mycology, was known for his exceptional teaching and profound kindness. A brilliant scientist first, he was also famous for supplying his students with a daily spread of the best quality pastries, cold cuts, cheeses, and endless pots of coffee. He was generous with PSMS, giving ID classes, talks, and organizing and recruiting members for citizen science studies. Red wine and good food figure in many stories.

When Dr. Stuntz died in 1983, his grad students, friends, and PSMS members wanted to honor him. They raised funds in his memory to assist students and researchers. This became the Daniel E. Stuntz Memorial Foundation.

Since 1983 The Stuntz Foundation together with its supported organization, the Stuntz Mycology Fund, has given over $648,000 in 158 grants, and 17 special projects including the Mushroom Maynia collaboration with the Burke Museum, lectures by visiting mycologists, and the endowment for the UW herbarium.

Patrice Benson served in nearly every role for PSMS including three terms as president. To list just a few of her other activities, she was a biotech entrepreneur, hematologist, mother of two daughters, and Stuntz Foundation president. Patrice was impossible to say no to and made everything fun and worthwhile.

Dr. Joe Ammirati, UW Professor Emeritus of Biology, succeeded Dr. Stuntz and benefitted PSMS in many ways. He gave lectures, ID classes in his lab, and served as our scientific advisor. In 2007 Patrice predicted that when Dr. Ammirati retired, there would be no one at the UW devoted to fungi.

With that in mind, Patrice led the Stuntz Foundation to establish an endowment at the UW to support a Collections Manager/Research Mycologist in the herbarium at the Burke Museum (also known as the UW herbarium). The reality is that faculty curators do not have the time to devote to maintaining and building collections the way that a staff person can. PSMS and the Stuntz Foundation provided initial funding to create the endowment in 2007. The fund now has about $700,000 and was recently renamed "The Daniel E. Stuntz and Patrice G. Benson Endowed Mycology Fund.

The UW herbarium is an internationally renowned collection supporting mycological research worldwide. It was founded in 1879 as part of the Young Naturalists' Society. C. Leo Hitchcock negotiated for the herbarium to be transferred to the Botany Department when he arrived in 1937. In 2003 the Botany and Zoology departments merged as the Biology Department, and the UW herbarium was administratively transferred to the Burke Museum.

The herbarium houses 700,000 specimens, of which approximately 117,000 are fungi (85,000 macrofungi; 32,000 lichenized fungi). The herbarium serves many purposes and audiences: (1) it is the primary specimen repository for documenting the diversity and distribution of Pacific Northwest plants, fungi, and algae; (2) the collections are an invaluable source of plant, fungi, and algae DNA used for discovering new species and exploring evolutionary relationships within these organismal groups; (3) herbarium specimens are loaned to researchers around the world, and serve as the primary source of undergraduate and graduate student research at the University of Washington; (4) approximately 450,000 of the herbarium's 700,000 specimens are freely accessible online; (5) the herbarium conducts public outreach that helps build community among those interested in the organismal groups represented in the collections.

In June, members of the Stuntz Foundation board will meet with the Burke Museum's Executive Director and the newly hired Development Director to make a plan to raise additional funds. With a recently hired herbarium curator arriving this fall, the Collections Manager/Research Mycologist position has increased priority.

We will keep you all informed along the way. If this sounds like something you would like to help with, you can find me, Joanne Young, through the Stuntzfund.org website or in the PSMS member's directory.

SCIENTISTS HOPE FUNGI-SNIFFING DOG CAN SAVE SPECIES ON BRINK OF EXTINCTION

Angus Delaney

https://www.abc.net.au/, May 16, 2024

Calm and focused and with her nose pressed to the ground, Daisy is hard at work. In a forest in Melbourne's east, she's being drawn towards a smell emanating from something barely bigger than a grain of rice. A GPS tracker attached to her collar traces her movements. When she finally finds her target, she'll wag her tail to get the attention of her handler, Nick Rutter.

Zoos Victoria

Hypocreopsis amplectens.

On this occasion, she's found a tiny piece of rubber with a unique scent. It's interesting, but it's not her ultimate goal—the critically endangered tea tree finger fungus, *Hypocreopsis amplectens.*

Why the Fungus is Important

While some might struggle to see the value of the tiny, gnarled finger fungus, its critical importance is obvious to conservation scientist Michael Amor.

cont. on page 5

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CALENDAR

June 1	Field trip (see website)
June 11	Survivors Summer Social, 7:30 pm, CUH
June 17	Board meeting, 7:30 pm, CUH boardroom and via Zoom
Aug. 20	*Spore Prints* deadline

BOARD NEWS

Carolina Kohler

The first order of business this time will be to rectify an unforgivable omission in our last edition of the Board News. When listing the officers and trustees who have recently completed their terms and those newly elected who are replacing them, I failed to mention that Scott Maxwell was our **outgoing vice president**.

Scott became VP in June 2021, when Marion Richards needed to step down, and in the past three years he has been the major force behind our monthly membership meetings—scheduling speakers, coordinating with CUH, and working on the setup and tear down. He also navigated the turbulent COVID waters, establishing protocols together with the CUH, and has been continuing the Zoom efforts initiated by Marion Richards, signing contracts with CUH for classes and meetings, and helping with PSMS's outreach efforts. For all that and plenty more, thank you, Scott!

The board had quite the wide-ranging agenda at its meeting on Monday, May 20. The evening started with Derek Hevel's first update on this year's **Annual Wild Mushroom Show** (yes, work is already under way!) The Show Committee has some exciting changes coming up (a larger space for lectures!), and Derek once again stressed the importance of our volunteers' contributions. There will be volunteering opportunities for all skill levels and all commitment levels, so don't miss out on being part of one of the largest mushroom shows in the country! If you'd like to know more, contact volunteer@psms.org.

Up next was President Colin Meyer's report on the status of our **lease renewal**, which is all but finalized. We all look forward to having a more spacious room for our office, and the moving process should be starting very soon. This will also affect our shed storage space, which will be moving closer to our show venue to simplify transportation. We are researching potential locations, so let us know if you have any suggestions.

Field Trip Guides & Safety Chair Wren Hudgins then addressed a few instances we have noticed of **nonmembers taking part in our field trips**. It is PSMS's mission to foster the understanding and appreciation of mycology, and to that end our organization strives to remove barriers for those who want to be a part of it. If you know of anybody who would like to become a member but has financial (or other) concerns, contact us. We can find a way to make it work!

And on the topic of financial support, the board also reviewed the recommendations on what will be the first **Ben Woo scholarships** that PSMS will be granting after a short hiatus. The discussion is ongoing, but we hope to make the announcements soon.

Closing the evening, Marion Richards brought to our attention some very interesting opportunities for volunteering at the **NAMA Foray** at Cispus later this year. The foray takes place very soon after our own Ben Woo Foray, and it can be a wonderful opportunity to meet other mushroomers from around North America and share with them the wonders of our Pacific Northwest.

And that was all for a very busy evening! We will be seeing you all at our wonderful **Summer Social** on June 11**!**

60TH PSMS SURVIVOR'S SUMMER SOCIAL

Date: Tuesday June 11, 2024
Time: 7:30 pm – 9:30 pm
Where: Center for Urban Horticulture
3501 NE 41 Street
Seattle, WA 98105
Cost: $10.00 per member
MEMBERS ONLY

On Tuesday, June 11, in place of our regular membership meeting, we will have our 60th Survivor's Summer Social hosted by the PSMS board. PSMS will provide light finger foods and sweets

along with wine, beer, and nonalcoholic beverages. (This is not a dinner.)

The CUH meeting hall, courtyard, and atrium will be open. At this gathering we will introduce the PSMS officers and committee chairs who are present, so if you would like to meet with them, this is a good opportunity to do so.

IN PERSON ONLY – There will be no Zoom recording of this event. Masks are optional. Doors will open at 7:00 pm. Check-in will be at the front desk.

Space is limited and pre-registration is required to attend. Sign-ups will begin on June 1; you will be receiving a special announcement in your e-mail if you are on the PSMS email list.

This is always a wonderful gathering being able to meet and socialize with other PSMS members. Please join with us as we celebrate last year and look forward to the next.

AGAIN, DON'T DELAY. SPACE IS LIMITED.

LEADERSHIP CHANGE FOR FIELD TRIP SAFETY COMMITTEE

Wren Hudgins

Effective at the end of Spring field trip season 2024, long-time co-chairs of the Field Trip Safety Committee, Wren Hudgins and Dave Weber, will be stepping down. New co-chairs Andrew Graesser and Dave Dowd have already started assuming some leadership responsibilities. To celebrate this transition and to facilitate guides getting to know the new leadership, we held a BBQ at the home of Wren Hudgins on May 19, 2024. The club currently has 36 guides, 26 of whom attended this BBQ. Along with a few family members, attendees totaled 37.

Joe Zapotosky

Andrew Graesser & Wren Hudgins.

Karen Dawson

Dave Dowd & wife, Jen.

This group of guides has assumed an important place in club functioning in several ways. Several of us talk about how much more rewarding active membership is compared to passive. Here are some of their active contributions recently.

- When we teach a 101 class, we need helpers to come lay out breakfast goodies and make coffee. Guides often step up to do this.
- When we created new annual show ID labels a year ago, we organized a work party to help affix and alphabetize the new labels. Guides made up this entire group.
- This is a group that contains most of our up and coming intermediate level identifiers. Some come to ID clinics to further their skills.
- When our Nominating Committee needed strong candidates to run for election in the last election, we turned to the guides. Currently, our vice president, treasurer, and several board members are guides.
- Finally, they guide. They give up their own mushroom hunting time to guide beginners who otherwise would have no idea where to go. Even when mushrooms are few, guides can educate about habitat so beginners can begin to learn more about our mutual passion for mushrooms.

This is a strong and committed group, and our club continues to benefit from their contributions. Field trips are one of the things our club does very well, and the guides are a big part of that.

FIELD TRIP REPORT: April 27, 2024

Brian S. Luther

Andrew Graesser

Morning meeting, April 27, 2024.

We had 168 members sign in at this new location, with 63 being on their first PSMS field trip. It was drizzly for most of the day, but this didn't discourage anyone.

Brian S. Luther

Nicole Schmitt & Suzi Ibach.

Our morning hosts were Nicole Schmitt & Suzi Ibach, and they provided us with an outstanding selection of morning snacks along with unlimited hot coffee. They stayed at the shelter all day, so that allowed us to have nice long conversations. Thank you, Suzi & Nicole—well done!

We had ten groups led by the following field trip guides: Wren Hudgins, Dave Weber, Kim Sing, Sego Jackson, Andrew Graesser, Dave Dowd, Ashley Laabs & Kai Carpenter, Randy Richardson, Pat Coddington, and Andy Iwata. Because we had so many guides, almost everyone was able to sign up and go out with a group if they wanted to. Thanks to all who contributed.

I counted 50 different species of fungi brought in. I schedule the first spring field trip in western Washington where members are likely to find Oyster Mushrooms (*Pleurotus ostreatus*), and it was collected by several members. A few *Coprinellus micaceus* (Shiny or Mica Caps) were also found but not enough for a culinary creation. One member also found a single specimen of *Morchella americana* under a Cottonwood tree by the river, which is one of our native "Blond" morels. Those were the only good edible species found. Two interesting Ascomycetes collected were *Pseudoplectania nigrella*, which has very small (¼ in. in diameter—you had to look carefully!) jet-black cups on rotting wood, and *Cudoniella clavus*, which has opaque—translucent turbinate (top shaped) apothecia on wet vegetation. The rarest

cont. on page 4

Field Trip April 27, *cont. from page 3*

find of the day was *Contumyces rosellus*, a little pinkish-tan gilled mushroom which is found only in early spring here.


Brian S. Luther

Contumyces rosellus.

A good 25 members stayed for an excellent end-of-day potluck at 3:30 pm, with many tasty dishes. It would not be possible for me to elaborate on all of them, but in particular Sego Jackson made a crock pot of super delicious vegan mushroom "meatballs" in pasta sauce. He said this was the first time he'd ever made it, and it was a winning entrée for sure. He generously gave his recipe to others.

All in all a very fine first spring field trip. Everyone seemed to have a good time.

FIELD TRIP REPORT: May 4, 2024

Brian S. Luther

It was a rainy day for our second spring field trip, but fortunately we had the use of an excellent building with all the amenities. Usually at this location we have the morning meeting and mushroom ID tables outside, but most everything was inside on this Saturday.

Our morning hosts were Jacques Stevens & Debbie Johnson, who fed us with a great selection of breakfast snacks and coffee to get us going in the morning. Thank you, Jacques & Debbie! Special thanks also to our facility host, Joshua.

Seventy-six people signed in, and there were eight groups led by field trip guides, so everybody who wanted to go out with a group was able to. Thanks to all the field trip guides for their contributions.


Joe Zapotosky

Brian Luther identifying mushrooms, May 4, 2024, field trip.

It had been a dry early spring in this area, up until the day of this field trip. But still, 47 species of fungi were collected. Concerning edible fungi, some members found pretty nice collections of a couple of species of morels, some Pig's Ears (*Gyromitra ancilis*), several *Gyromitra montana* (Brain Mushroom or Walnut), some Oyster Mushrooms (*Pleurotus ostreatus*), and a large specimen of *Ramaria rasilispora*, which is one of our common spring coral mushrooms.

Interesting fungi included a good-sized collection of *Tricholoma vernaticum* and a clump of several *Mycena overholtsii* growing on wood near melting snow. The rarest fungus found was a small collection of *Helvella corium*, with a black cup and stem with a densely granular or short tomentose outer cup surface.


Brian S. Luther

Helvella corium.

About 20 members stayed for the potluck, and we all left satisfied after a great day out in the woods together.

FIELD TRIP REPORT: May 10–12, 2024

Brian S. Luther

Wren Hudgins came over to our home early Friday morning, and together we headed over the logging roads to the field trip site, cutting firewood en route. Once there, we did a little scouting together, then Wren went on his own scouting potential locations for field trip guides.

Peg and Tom Rutchik were our Saturday morning hosts, and everybody really appreciated all they provided and did. This is a remote, nonelectric site, and we were lucky to have the use of Dave & Wuqi Weber's generator to be able to make coffee and hot water. Special thanks, Tom, Peg, and Dave!


Brian S. Luther

Saturday morning coffee and breakfast snacks, May 11, 2024.

Unusual for this distant location, we had nine groups led by field trip guides, thanks to Wren Hudgins, Dave Weber, Dave Dowd, Karen & Clay Dawson, Serhat Cetinkaya, Liz Perpetua, Julia Benson, Derek Hevel, and Vern Hodgson.

Forty-nine members signed in for a fun weekend of camping and mushroom hunting together. The temperature was in the 80s in the shade and in the 90s in reality; the summer-like conditions were not conducive for finding many mushrooms. Several members took dips in the Mad River to cool off during the days. There was a strong solar outburst at the time, which gave members a rare sighting of the aurora borealis on Friday and Saturday nights. Those who stayed up said it was gorgeous. Although the days were hot, the evenings and nights cooled off significantly, so we had lovely nighttime and early morning campfires for socializing.

I counted 40 different species of fungi—which was very slim "pickin's." Julia Benson found a few of the prized spring bolete *Boletus rex-veris* on her way over, but no one else found any. Several members found at least a few morels, but nothing in abundance. Several Brain Mushrooms (*Gyromitra montana*), some *Gyromitra ancilis* (formerly *Discina perlata*), and one clump of Oyster Mushrooms (*Pleurotus ostreatus*) came in—and that was it for edibles. Nothing unusual or unexpected was collected.

I went back home Friday evening, after getting a fire going; it only takes me about 40 min. taking the Forest Service roads. I returned again by 7:00 am Saturday, staying just for the day. The Saturday potluck was delightful, with a great selection of tasty dishes prepared by all. We had no complaints about how the weekend went, even though mushrooms were scarce.

Alice Algae took a lichen
To Freddy Fungus
And now their relationship is
Is on the rocks
And they are living in
"Sin"biosis!

Fungus Sniffing Dog, *cont. from page 1*

It's a species only known to be in six locations in Victoria, and Amor has observed fewer than 100 specimens in his years of research.

"Fungi are a very vital part of our planet; they provide food for animals, they help with nutrient cycling and purifying water systems, they help with plant productivity," Amor says.

The Royal Botanic Gardens Victoria's Shari Barmos, who has studied the fungus for years, says scientists are just beginning to discover the importance of the "amazing species" in the ecosystem.

"Not only does it look like something completely alien to use but the role it plays in the ecosystem gives us a broad understand of how that ecosystem is functioning," she says.

Alongside Daisy the dog, Barmos uses a mirror to painstakingly check under tree branches for the elusive fungus.

"[It's] very difficult, not only are there not many of them out there but … we are looking for a very small brown fungus that looks exactly like the branches it's found on," Barmos says.

But while Barmos searches with her eyes, Daisy is using a much sharper sense: smell.

Research conducted by the Royal Botanic Gardens Victoria and Zoos Victoria has put Daisy and Barmos head-to-head in their search for the tea tree finger fungus.

"Daisy was able to find a greater proportion of targets, she found them faster, and she had less chance of leaving an area and failing to detect a fungus," Amor says.

"When we worked with Daisy and Shari, we had a 95 percent success rate of finding a fungus.

"It shows with our team now we have high confidence that if we go out and look, we will find tea tree fingers if it's there."

Zoos Victoria

Daisy's finely tuned nose isn't just unique to Australia—those involved in the project believe she's the only dog being used to sniff out fungi for conservation purposes worldwide.

Daisy on the job.

A Dogged Approach

As a Lagotto Romagnolo (an Italian water-dog breed often used for truffle hunting), Daisy is gifted with a special sense of smell.

It's been Nick Rutter's mission to hone that in on efforts to save the critically endangered tea tree finger fungus (TTF).

Rutter has been training Daisy for six years, developing her sense of smell to zero-in on species like the earless dragon and Tasmanian devil.

Targeting TTF was a unique process in itself.

"The training to teach Daisy to find TTF is basically pairing the smell of this special little fungus with a reward so that every time Daisy comes across this smell, she gets to have a party with me," Rutter says.

"It was a bit of a long process because it's such a rare fungus, opportunities to train her and to find the fungus are quite limited.

"But after some training sessions and some pretty dedicated detection dog sniffing, we got there in the end and were able to find it in the wild."

Daisy and Rutter's success is reliant on more than intense training, but the bond they share.

"We have been having quite a special connection and bond over the course of her career which makes the job of looking for really endangered species all that easier," he says.

"It helps when we are searching for a long time and not finding much.

"I can kind of see what she's thinking and she can read me really well."

To Barmos, the teamwork between her trained eyes and Daisy's trained nose is "priceless."

"I like to call it collaboration not competition," she says.

PSILOCYBIN SHOWS PROMISE IN ANOREXIA TREATMENT

Claire Foldi

https://neurosciencenews.com/, May 13, 2024

Characterized by pathological weight loss driven by restrictive feeding and excessive exercise behaviors, anorexia nervosa has one of the highest mortality rates of any psychiatric disease.

The condition is marked by cognitive inflexibility, or rigid thinking, and there is evidence that psilocybin acts to decrease this inflexibility.

Some small clinical trials have shown that psilocybin, the active ingredient in magic mushrooms, may be a potential treatment for anorexia nervosa. However—crucial to the use of the drug as a recognized treatment for anorexia—is the need to understand how psilocybin actually works in the brain.

Now, a study led by Dr. Claire Foldi from the Monash University Biomedicine Discovery Institute and published in the journal *Molecular Psychiatry*, has studied psilocybin in an animal model of anorexia nervosa—revealing that it improves body weight maintenance in female rats and facilitates cognitive flexibility.

Importantly, the Monash researchers found a specific mechanism within the brain by which psilocybin works to make "anorexic thinking" more pliable, opening the way for targeted therapies.

According to Foldi, while selective serotonin reuptake inhibitors (antidepressants) are the leading pharmacological treatment, they are used off-label and "they do not improve clinical symptoms in underweight individuals with anorexia," she said.

cont. on page 6

Psilocybin vs Anorexia, *cont. from page 5*

"Cognitive inflexibility is a hallmark of the condition often arising before symptoms of anorexia nervosa are obvious and persisting after weight recovery—making this symptom a primary target for therapeutic intervention."

USING ADVANCED MOLECULAR TECHNIQUES TO DETECT HARMFUL FUNGI AND TOXINS IN SPICES

Greg Howard

https://naturalsciencenews.com/, May 17, 2024

Spices are integral to culinary traditions worldwide, including Iraq, where they are extensively used for flavoring food. However, these popular ingredients can be susceptible to contamination by toxicogenic fungi, which can produce harmful mycotoxins. A recent study conducted by the University of Sulaimani aimed to investigate the extent of fungal contamination in commonly used spices and to detect the presence of mycotoxins using advanced techniques.[1]

The study focused on 35 spice samples, including black pepper, red pepper, turmeric, cumin, and ginger. These samples were cultured on an appropriate medium to identify various fungal species. The researchers employed polymerase chain reaction (PCR) assays to determine the toxigenicity of *Aspergillus flavus* and *Aspergillus niger*, two common fungal contaminants. They also used high-performance liquid chromatography (HPLC) with the QuEChERS method to detect fungal mycotoxins, specifically aflatoxins and ochratoxins.

Aspergillus species were found to be the predominant fungi in the spice samples, followed by *Penicillium* and *Fusarium* species. The PCR results revealed a high toxigenicity of *A. flavus*, with 85.7 percent of the strains possessing the aflQ/aflR genes and 79 percent containing the PKS15KS/PKS15C-MeT genes. These genes are known to be involved in the production of aflatoxins, a group of potent carcinogenic toxins. The highest rates of aflatoxins and ochratoxins were detected in black pepper (5.913 µg/kg) and red chili (6.9055 µg/kg), respectively.

This study builds on previous research that has highlighted the risks posed by *Aspergillus* species in agricultural commodities. For example, earlier studies have shown that maize, a staple crop in Saudi Arabia, is often contaminated with *A. flavus* during storage.[2] These studies used a combination of microscopic morphological, biochemical, and molecular characterizations to identify aflatoxigenic and non-aflatoxigenic isolates. The findings emphasized the importance of accurate detection methods like real-time PCR (RTi-PCR) and HPLC for identifying aflatoxigenic isolates, which pose significant health risks.

Similarly, another study isolated *Aspergillus flavus* from feed and grain samples, confirming all isolates to be aflatoxigenic through DNA sequencing and toxin-producing ability test.[3] This research underscored the potential risks of *A. flavus* contamination in agricultural commodities and the need for proper harvest and storage management to mitigate these risks.

The findings from the University of Sulaimani's study are particularly concerning given the widespread use of spices in daily cooking. The presence of mycotoxins in spices poses a significant health risk, as these toxins can lead to various health issues, including liver damage and cancer. The study's use of advanced techniques like PCR and HPLC provides a reliable method for detecting these contaminants, thereby enabling more effective surveillance and quality control measures.

In light of these findings, it is crucial to implement regular and effective surveillance and quality control procedures to ensure the safety of spices. This includes monitoring for fungal contamination and mycotoxin levels, as well as educating producers and consumers about the risks and proper storage practices. By taking these steps, we can help mitigate the health risks associated with contaminated spices and ensure that they remain a safe and flavorful part of our diets.

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A SPECIAL PELLET AND FUNGUS OFFER MULTIPLE PROTECTIONS TO MEALYBUGS

Jim Crocker

https://naturalsciencenews.com, May 17, 2024

Insects and fungi often form intricate mutualistic relationships, where each partner benefits from the other's presence. These mutualisms can evolve to become highly specialized, with both insects and fungi developing unique adaptations to support their interaction.[2] A recent study by Zhejiang University has uncovered new insights into such a mutualism involving mealybugs and the fungus *Penicillium citrinum*.[1]

Mealybugs are significant agricultural pests that can cause extensive damage to crops. While it is known that beneficial fungi can aid insects in adapting to various environments, the specific locations and mechanisms of these interactions have remained elusive. This study reveals that mealybugs feeding on tomato plants develop a unique pellet-like structure on their legs which houses *P. citrinum*. Interestingly, this structure does not form when mealybugs feed on other plants such as cotton, potatoes, or eggplants.

The formation of these leg pellets is a collaborative process involving secretions from the host plant and waxy filaments produced by the mealybugs. Within these pellets, the researchers identified the presence of *P. citrinum*, a fungal strain that also colonizes the honeydew excreted by the mealybugs. This fungus plays a crucial role in protecting mealybugs by inhibiting fungal pathogens that could otherwise harm them. The compounds found within the pellets exhibit inhibitory activity against these

pathogens, enhancing the survival rate of mealybugs under pathogen pressure.

The study also found that these leg pellets provide additional benefits to the mealybugs. They increase the frequency with which the insects suck plant sap and reduce the defensive responses of the host plants, thereby facilitating easier feeding and greater nutrient intake for the mealybugs.

This discovery ties into previous research on insect–fungus mutualisms. For instance, ambrosia beetles are known to carry fungal symbionts in specialized structures called mycangia, which help them farm these fungi as a nutritional resource.[3] Similarly, necrophagous beetles use antimicrobial secretions to regulate the microbial communities on carrion, creating a favorable environment for their larvae.[4] These examples illustrate how insects utilize fungi not only for nutrition but also for protection and environmental manipulation.

The findings from the Zhejiang University study expand our understanding of these complex interactions by highlighting a novel mechanism through which mealybugs and *P. citrinum* interact. The leg pellets represent a unique adaptation that enhances the mealybugs' ability to thrive in specific environments, similar to the specialized structures seen in other insect–fungus mutualisms.

In conclusion, this study sheds light on the intricate relationships between mealybugs, fungi, and host plants. By forming leg pellets that house beneficial fungi, mealybugs can protect themselves from pathogens and manipulate their environment to their advantage. This research not only provides new insights into the coevolution of insect-fungi-plant interactions but also opens up potential avenues for developing strategies to manage mealybug infestations in agriculture.

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RESEARCHERS FIND UNIQUE ADAPTATIONS OF FUNGUS ASSOCIATED WITH BEE BREAD

Ananya Sen

https://phys.org/, May 21, 2024

The past attempts of honey bee researchers to inventory the fungal diversity in honey bee colonies revealed that *Aspergillus flavus* is frequently found in hives. In a new study, researchers have discovered that this fungus is uniquely adapted to survive in bee colonies.

The study, "An *Aspergillus flavus* strain from bee bread of the Western honey bee (*Apis mellifera*) displays adaptations to distinctive features of the hive environment," was published in *Ecology and Evolution.*

The western honey bee, *Apis mellifera,* stores large quantities of food in the form of bee bread, which is used as a main food source for the hive. The abundant nutritional value of this food source also makes it an appealing target for microorganisms. However, bee bread is acidic with little moisture and is doused with the antimicrobial chemical propolis.

Despite the inhospitable nature of bee bread, the microbiome in hives consists of several bacterial and fungal species that are important to honey bee food preparation, storage, and digestion.

"Most of the research on bee bread has been focused on bacteria, and it was assumed that fungi didn't play a big role because the bacteria made it too inhospitable to them," said Daniel Bush, a graduate student in the Berenbaum (IGOH/GEGC/ GNDP) lab.

"After talking to mycologists, I suspected that wasn't the case and I set out to demonstrate that fungi were capable of living successfully in bee bread."

In the study, the researchers used three strains of *A. flavus*: one that is not found in bee hives, a strain that was isolated from hives in central Illinois, and a pathogenic strain from a honey bee colony that had a stonebrood infection.

They first tested whether the strains showed any differences in their responses to pH and temperature. The latter was looked at because hives are characterized by higher year-round temperatures compared to the outside environments, which is a challenge for many microbes.

Although the strains were all able to grow across different temperature ranges, they had visible growth differences under different pH conditions. The strain that was isolated from the hives was able to withstand low pH, while the other two could not.

The strains were also tested under different matric potential, which measures how much moisture is available, and response to propolis.

"We saw that the strain from the hive was capable of dealing with extreme levels of environmental pressure from colony-specific sources," Bush said. "It was interesting that it could deal with propolis, which is believed to have fungicidal properties."

To better understand how the hive-associated fungal species were able to adapt, the researchers also sequenced the *A. flavus* strain and found that it had several genetic mutations that allowed it to tolerate the harsh conditions of the bee bread environment.

"We believe that these are signs that there is a level of adaptation for the fungus that helps it cohabitate with the bees," Bush said. "We suspect that there is some mutual benefit to both organisms, but we haven't found sufficient evidence yet."

The researchers are now hoping to study how the fungus performs on different compositions of bee bread during their life cycle. They hope that their work will shed light on how fungicides that are routinely used to protect the bee hives will affect these microbes.

Bee bread is a natural product obtained from the fermentation of bee pollen mixed with bee saliva and flower nectar inside the honeycomb cells of a hive.

MORCHELLA BRUNNEA: One of Our Fabulous Morels

Brian S. Luther


Brian S. Luther

Morchella brunnea.

Two of the 12 (or so) morels native to Washington State are found associated only with broadleaf (flowering) trees. One of these is *Morchella brunnea*. It's most often found in association with living Cottonwoods (*Populus trichocarpa*) or Quaking Aspen (*P. tremuloides*), but can also sometimes be found around other broadleaf trees. This species is never found in burn sites. Our other related morel that occurs only with hardwoods is *M. populifila* (name means associated with the genus *Populus*). Because these two are found in the same habitat, this last species is distinguished by being our only morel with the cap half attached to the stem—in other words having a big gap (about halfway) between the cap and stem on the upper part. In the older literature we used to call this last species *M. semilibra.* This character is not as pronounced as with the genus *verpa*, where the cap is attached **only** at the very apex of the stem, and Verpas should never be eaten.

On our property in Chelan Co. (central WA), we have riparian meadows with very large, old Cottonwoods and Aspens, and in late April or early May, we have *M. brunnea* fruiting in abundance. This year they started emerging later than usual. I keep a close watch looking for them toward the end of April, but we had a very dry early spring. Every time I went to look for any signs of them, I saw nothing. But then we got a single day of pretty heavy rainfall, actually a soaking rain, but I failed to go check for them a week later. Well, I was doing my big mowing with our large commercial mower on May 8, and when I got to the place I normally find them I happened to look down ahead and saw one large morel sticking out of the grass at me, but *only* after unknowingly having just mowed over a half dozen others—yikes. I came to a screeching halt. Low and behold the morels were everywhere. It was a comical sight, because I'd clipped just the top 1/4 inch off some before seeing them, leaving them otherwise intact! I quickly shut down the mower and went back to the house to tell my wife; we both came back prepared to harvest them all, which we did.

Morels! Morels!
The musical sound
The more you look
The more will be found
The more you find
The better you feel
So eat more morels
in every meal
—Eva Villanueva

EASY VEGAN MOREL STROGANOFF

Brian and Pam Luther

Ingredients

~20 Morels
Trader Joe's Beefless Ground Beef
or Beefless Korean Bulgogi
Olive or canola oil
Whole onion
Plant-based sour cream
Fresh garlic
Paprika


Brian S. Luther

Preparation

1. Chop up and sauté the morels thoroughly—we cook them for *at least 10 min.* to be sure to cook out all the toxins. *Never eat raw or lightly cooked morels*; you may get sick if you do. Being vegans we often cook mushrooms in their own juices or with water, but sometimes we add a small amount of olive or canola oil. Remove from the pan.
2. Chop, sauté, and brown a whole onion and some fresh garlic, then mix this with a package of Trader Joe's Beefless Ground Beef (12 oz.) or Beefless Korean Bulgogi (10 oz.) (both soy based), already cooked/thawed in the microwave.
3. Add the cooked morels to this mixture. Then add a container of plant-based sour cream to all of the above and mix it in. Many stores and brands make and carry this now. The amount you add is based on how you like the consistency, thicker or thinner. We tend to put in quite a bit, so it's less thick. Then we like adding several dashes of paprika on the top of the whole mixture, which just makes it more appealing and decorative than anything else.

We personally like putting this mixture over cooked brown rice. And, since we learned years ago that brown rice contains small amounts of arsenic, we take care of that problem by first soaking the raw brown rice in water over night, then draining it completely and discarding the water before cooking it in fresh water. This eliminates 80 percent of the arsenic, but there are other procedures you can use as well, all available online.

We then serve this with a steamed vegetable. When I made this for Pam on Mother's Day, we cut and steamed some of our home-grown asparagus, which is sprouting at the same time our morels appear.

If you're not vegan, then it's very simple to substitute some kind of ground meat and use regular dairy sour cream in this recipe.

This will be your last newsletter until September.
Have a great summer!