SPORE PRINTS

BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY
Number 618 January 2026

OUTBREAK OF POTENTIALLY DEADLY AMATOXIN POISONING LINKED TO THE CONSUMPTION OF WILD, FORAGED MUSHROOMS

https://www.cdph.ca.gov/, Dec. 5, 2025

The California Department of Public Health is issuing an urgent advisory following a recent outbreak of amatoxin poisoning linked to the consumption of wild, foraged mushrooms. Confirmed cases have resulted in severe liver damage in both pediatric and adult patients, including one adult fatality. As of December 5, 2025, twenty-one cases have been identified by the California Poison Control System (CPCS) with significant clusters reported in the Monterey and San Francisco Bay Areas, although there is risk statewide.

"Death Cap mushrooms (*Amanita phalloides*) contain potentially deadly toxins that can lead to liver failure, said Dr. Erica Pan, CPCS Director and State Public Health Officer. "Because the Death Cap can easily be mistaken for edible safe mushrooms, we advise the public not to forage for wild mushrooms at all during this high-risk season."

Toxic Death Cap Mushroom (Amanita phalloides).

Toxic mushrooms such as the Death Cap can easily be mistaken for safe, edible mushrooms owing to their similar appearance and taste. Consuming these mushrooms can lead to severe poisoning. Cooking, boiling, drying, or freezing these mushrooms does NOT make them safe to eat.

Healthcare providers should be aware of the potential for toxicity following wild mushroom ingestion. Initial symptoms, such as watery diarrhea, nausea, vomiting, abdominal pain, and dehydration can occur within 6 to 24 hours following ingestion of these toxic mushrooms and usually go away within a day. However, this brief improvement can be deceptive, as patients may still develop serious to fatal liver damage within 48 to 96 hours after eating the mushrooms. Healthcare providers are advised to contact the national poison control center at 1-800-222-1222 for guidance on diagnosing and treating patients with suspected mushroom poisoning.

Between mid-November and early December 2025, CPCS identified 21 cases of toxic mushroom poisoning likely due to Death Cap mushrooms. Several patients have required intensive care, with at least one individual potentially needing a liver transplant. One adult fatality has also been reported to date. The California Poison Control System is closely monitoring the increase in calls related to hospitalizations of individuals who have consumed toxic foraged wild mushrooms. It is also providing guidance to health care providers treating patients with toxic mushroom poisoning.

Death Cap mushrooms are found in many parts of California, particularly near oaks and other hardwood trees, and pine trees. Rain in the fall and winter months creates ideal conditions for their growth. Given the grave risk posed by consuming these toxic mushrooms, the California Poison Control System strongly advises the public to avoid foraging wild mushrooms and to only consume mushrooms purchased from reputable stores or known commercial sources.

WHAT TO KNOW ABOUT DEATH CAP MUSHROOMS, BLAMED FOR POISONINGS IN CALIFORNIA

Rachel Treisman

https://www.npr.org/, Dec. 10, 2025

California authorities are warning people not to eat foraged mushrooms for the time being after nearly two dozen people were sickened—including one fatally—by a highly poisonous mushroom known as the Death Cap.

The California Department of Public Health (CDPH) said in its advisory that there have been 21 confirmed cases of toxic mushroom poisoning—which it says is "likely" from consumption of Death Caps—between mid-November and last Friday.

Toxins from the mushrooms killed one adult and caused severe liver damage in kids and other adults. Several patients required intensive care, "with at least one individual potentially needing a liver transplant," health officials added.

Officials said there have been "significant clusters" of cases reported in the Monterey and San Francisco Bay areas, but are warning of risk statewide.

"Because the Death Cap can easily be mistaken for edible safe mushrooms, we advise the public not to forage for wild mushrooms at all during this high-risk season," said CDPH director Dr. Erica Pan.

Death Cap mushrooms are known to grow in many parts of California, fueled especially by the fall and winter rain.

Death Cap Mushroom (Amanita Phalloides).

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Spore Prints

is published monthly, September through June by the
PUGET SOUND MYCOLOGICAL SOCIETY
Center for Urban Horticulture, Box 354115
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(206) 522-6031 http://www.psms.org

CALENDAR

Jan. 13 Membership meeting, 7:30 pm, CUH
Jan. 19 Board meeting, 7:30 pm, CUH board room
Jan. 23 *Spore Prints* deadline
Feb. 10 Membership meeting, 7:30 pm, CUH

BOARD NEWS — Valerie Costa

December's board meeting was a quick one after a busy fall foraging season! The board discussed adjusting the vice president's responsibilities so that they would not require deep familiarity of the mycological community for sourcing speakers, noting that support networks and speakers shared across clubs can help meet this need. No changes were made to the role's description. The board continues to seek additional suggestions for the vice president's role.

The board also discussed establishing background and reference checks for all incoming treasurers prior to their assuming office.

Nominations will close at the close of the general meeting in January.

Marian Maxwell reported that the Nominating Committee has identified candidates for all board positions. Marian also shared attendance and budget information from the December social. The registration limit was set at 160. One hundred and fifty-seven were expected. However, 19 of those registered did not attend, resulting in 138 actual attendees. While final numbers are still pending, the event is expected to exceed its budget, so we may need to increase ticket prices slightly for next year's social.

Kelsey Hudson led a discussion of nominees for the Golden Mushroom Award—stay tuned to learn who the 2026 winner will be!

MEMBERSHIP MEETING — Joseph Zapotosky


Dustin Howard, La Liberté Productions
Dr. Roy.

Our speaker for January is Dr. Bitty Roy, Professor Emerita at the University of Oregon. Dr. Roy is a renowned mycologist, forest ecologist known for her wide-ranging research on fungal ecology, plant–microbe interactions, and the impacts of environmental change on forest health. Her work spans continents and disciplines, from studying pathogen dynamics in tropical forests to uncovering the intricate relationships among fungi, trees, and disturbance in the Pacific Northwest.

In recent years, Dr. Roy has focused extensively on the ecology of oaks, their associated fungal communities, and the role fire plays in shaping these symbioses. Her research combines field observation, experimental ecology, and community science partnerships to better understand how fungi influence the resilience and regeneration of oak ecosystems.

Dr. Roy is also well known to regional mushroom enthusiasts for her engaging teaching style, contributions to mycological societies, and her ability to connect complex scientific concepts to real-world forest issues. Her work continues to deepen our understanding of how fungi, fire, and trees intertwine to shape the landscapes of the West.

Please join us at our monthly membership meeting on Tuesday, January 13th, at the Center for Urban Horticulture, University of Washington. Doors open at 7:00 pm.

There will not be a live Zoom presention of this event, but we will post the talk afterward on our website at psms.org for members only. The recording will be available for 30 days.

SO, WHAT'S GOING ON HERE? — Brian S. Luther

You're looking at a clump of *Suillus caerulescens* (one of our Slippery Jacks) with an associated clump of *Gomphidius oregonensis*. These clusters of unrelated species are not just an accidental growth of the two side by side, as can often be the case with other fungi. In fact, the *Gomphidius* is parasitizing the mycelium of the *Suillus*. Species of *Suillus* are all obligately mycorrhizal; *S. caerulescens* is most often found near Douglas Fir trees because its mycelium forms an ectomycorrhizal symbiotic relationship with the roots of primarily that tree. Other *Suillus* species may be mycorrhizal with the same or different trees. It's common

Brian S. Luther

Suillus caerulescens and Gomphidius oregonensis growing next to each other.

to see several different Slippery Jacks along with *Gomphidius* spp. because the parasitic association between them is species specific. If you have a copy of the excellent book *Mushrooms of the Redwood Coast* (Siegel & Schwarz, 2016), then go to page 410 and read about this relationship. They document most of the species of *Suillus* and *Gomphidius* that are often found together here in the PNW, because of the very specialized parasitic situation between them.

Brian S. Luther

Another view of the two.

But, another species that's found here, and is parasitic on *Suillus*, is *Gomphidius maculatus*. It's our only species of *Gomphidius* that's specifically associated with Larch trees (the genus *Larix*), or rather the *Suillus* species that are mycorrhizal with Larch. Here in Washington State we have two native Larch species: *L. occidentalis* (Western Larch) and *L. lyallii* (Alpine Larch). Our common species of *Suillus* associated with these Larch trees include *S. ampliporus* (previously known as *S. cavipes*), *S. clintonianus* (previously *S. grevillei*), *S. ochraceoroseus* (previously *Fuscoboletinus*) and *S. elbensis* (previously known as *Fuscoboletinus aeruginascens*, *F. viscidus*, and *S. laricinus*).

The related genus *Chroogomphus* is also parasitic in the same way as *Gomphidius*, but on species of boletes. Curiously, this relationship can be used to track down one of our excellent edible mushrooms. It turns out that the mycelium of *Chroogomphus tomentosus*, one of our two "False Chanterelles," specifically parasitizes the mycelium of *Aureoboletus* (*Boletus*) *mirabilis*—the Admirable Bolete. *Chroogomphus tomentosus* is very common in fall, so if you find it, be sure to look around some more and you just might also discover this tasty bolete nearby.

We have lots of wildlife where we live, and the day after I photographed the specimens shown here, the deer had eaten the entire group of the mushrooms, down to nothing.

MUSHROOM CAUSES FAIRYTALE-LIKE HALLUCINATIONS

Colin Domnauer

https://attheu.utah.edu/, Nov. 25, 2025

Picture this: You're enjoying a delicious bowl of mushroom soup, when suddenly you notice hundreds of tiny people dressed in cartoonish clothing marching across your tablecloth, jumping into your bowl, swimming around, and clinging to your spoon as you lift it for another taste. You're not dreaming—you've just experienced the effects of a mushroom known scientifically as *Lanmaoa asiatica*. It belongs to an entirely different class of fungi than the more commonly known "magic mushrooms" and remains far more mysterious.

When outsiders first embarked into the Western Highlands of Papua New Guinea in 1934, they encountered a perplexing sight: after consuming a type of wild mushroom which they called "nonda," the local people would appear to go temporarily insane, exhibiting a sudden and striking change in mood and behavior. Subsequent accounts of the "mushroom madness" phenomenon, as it was termed, provided more details into the mushroom's strange psychological effects.

Specifically, it was reported that those affected would experience lilliputian hallucinations—a rare, clinically defined psychiatric syndrome (named after the tiny people in Gulliver's Travels) characterized by the perception of numerous little people autonomously moving about and interacting in the real-world environment. One elder tribesman in Papua New Guinea describes this effect, explaining how "he saw tiny people with mushrooms around their faces. They were teasing him, and he was trying to chase them away."

By the 1960s, scientists were working to identify the species of mushrooms involved and the chemicals that might be responsible for such bizarre effects. However, both questions have remained unanswered to this day. As a Ph.D. student at the Natural History Museum of Utah, I've been working to solve this puzzle: What exactly is the identity of this mushroom, how widespread is the cultural knowledge of its effects, and why does it produce such fantastical visions?

Investigating Lilliputian Mushrooms in China

Home to 40 percent of the world's wild edible fungi, Yunnan, China, has always been remarkable for mushroom lovers. But in the last decade or so, the summer rains have brought more than just mushrooms; they've been accompanied by an explosion of news articles that read like something out of children's fairy tales. After consuming a popular wild mushroom known locally as "Jian shou qing," locals frequently report having unbelievably bizarre experiences, most notably characterized by seeing "xiao ren ren," or little people.

A professor in Yunnan recounted how one evening during dinner, he began seeing swirling shapes and colors after eating stir-fried mushrooms. Since the psychoactive effects are familiar to most locals, he began looking for xiao ren ren but was disappointed to find none—until he lifted the tablecloth and peeked underneath, seeing "hundreds of xiao ren ren, marching like soldiers."

Even more curious, he said, "when I lifted the tablecloth higher, the heads came off and stuck to the bottom of the cloth and the bodies kept marching in place…. I did this many times, at two-minute intervals, and each time they were there, marching and grinning…. I measured them, too…they were 2 cm high." According to records at Yunnan Hospital, 96 percent of patients affected by this mushroom report seeing an abundance of "little people" or "elves," often dancing, jumping, or marching around their real-world environment.

As recently as 2014, the taxonomic identity of the psychoactive Jian shou qing mushroom remained unknown. It wasn't until mycologists in Yunnan purchased and sequenced the mushrooms being sold in an open-air street market (where it had been sold for decades) that the species was officially described and recognized as being new to science. Its formal Latin name is *Lanmaoa asiatica*, and, interestingly, it's more closely related to the common porcini (Utah's official state mushroom) than to any other currently known hallucinogenic mushroom species.

cont. on page 4

Fairytale Mushroom, *cont. from page 3*

Although *Lanmaoa asiatica* is a recent scientific discovery, the knowledge and use of this psychoactive mushroom may have much deeper ancient roots in Chinese culture. A prominent Daoist text from the 3rd century CE refers to a "flesh spirit mushroom," which, according to the text, if consumed raw, allows one to "see a little person" and "attain transcendence immediately."

Colin Donnauer

Lanmaoa asiatica.

A Global Experience

Surprisingly, I became aware of yet another independent report of the exact same phenomenon—a mushroom that caused lilliputian hallucinations from an entirely different region of the world. Indigenous communities in the Philippines' remote Northern Cordillera were collecting and consuming a wild mushroom which, according to local knowledge, occasionally evokes visions of little people, which they call the "ansisit." The mushroom is known locally as "Sedesdem." Just like the "Nonda" in Papua New Guinea and "Jian shou qing" in Yunnan, it is a culturally esteemed wild edible mushroom that, if undercooked, produces bizarre yet remarkably consistent psychoactive effect.

As no scientific surveys of the mushrooms in the Northern Philippines had been conducted, Sedesdem's taxonomic identity remained unknown, leaving me with the obvious task. I travelled to this community in 2024 to explore the mushrooms and experience the culture surrounding this phenomenon. By working with local guides and foraging through the forest, we collected samples that are now preserved for scientific study at the Natural History Museum of Utah—allowing us to perform the first DNA sequencing of this region's fungi.

What surprised me most was the unexpected discovery of the Sedesdem mushroom's identity: it was none other than *Lanmaoa asiatica*, the exact same species as in Yunnan. The puzzle was coming together.

More Than Folklore or Tall Tales

That the same peculiar hallucinations are independently reported across distant cultures indicates that these bizarre psychological effects are not cultural fabrications or coincidences, but manifestations of a shared underlying chemical and neurological basis.

Chemical and genomic analyses performed on *Lanmaoa asiatica* at the Natural History Museum of Utah have revealed no traces of any known psychoactive compounds, suggesting that something entirely new is waiting to be discovered. In other words, *Lanmaoa asiatica* appears to harbor a chemical compound capable of reliably evoking this unusual experience of lilliputian hallucinations. The discovery of that chemical may, in fact, hold the key to understanding one of the most mysterious dimensions of the human psyche.

Ongoing Research into the Fairytale Mushroom

Our efforts to identify this compound are ongoing, and the progress so far has been exciting! When mice are given chemical extracts of *Lanmaoa asiatica*, their behavior shifts noticeably compared to controls. By continuing to fractionate these extracts and testing each in turn, we've been steadily narrowing in on isolating the specific bioactive molecules involved.

But the chemistry is only part of the mystery. In parallel, I'm building a global database of all *Lanmaoa* species. In doing so, I've discovered four new species previously unknown to science. Through full-genome sequencing, I've been able to clearly map the evolutionary relationships and history of *Lanmaoa* for the first time, allowing us to search for patterns that might reveal where and why psychoactivity evolved in this group. For example, genomic analysis reveals that the closest relative of *L. asiatica* is a species commonly found (though rarely eaten) here in North America. While there are no reports of it being psychoactive in the U.S., it's entirely plausible its effects have simply gone unnoticed.

Exciting Discoveries are Waiting for Us

I'm fascinated by how far the knowledge of these mushrooms extends, across both space and time. Are there additional cultural traditions and groups surrounding this psychoactive species that have yet to be documented? Does humanity's knowledge of this mushroom and its most bizarre effects stretch further into history, and deeper into folkloric beliefs, than we currently appreciate? Given the remarkable findings we've made in just the past few years, I believe the answer to both these questions is yes.

While many questions remain, one thing is certain: *Lanmaoa asiatica* reminds us that the world of mushrooms, even those found in markets and on dinner plates, conceals mysteries and wonders we've yet to imagine. Somewhere between traditional folklore and modern biology, between the wild forest floor and the sterile scientific laboratory, lies a story still unfolding, a story that may begin with something as seemingly innocuous as a bowl of mushroom soup.

IS CHINA'S YOUTH REALLY KEEPING MOLD FROM TEA LEAVES AS PETS? Mandy Wong

https://radii.co/, Dec. 12, 2025

Baidu

A peculiar new trend is brewing among China's youth, one that might make your stomach churn but has captivated social media: cultivating "tea fungi"—essentially mold—from bottled tea drinks and keeping them as pets. Forget hamsters or goldfish; for many young Chinese, a fuzzy, spherical blob growing in leftover tea is the ultimate low-maintenance companion. *Pet mold.*

The phenomenon took off on social media, with users posting photos of white or translucent fungal clusters thriving in popular bottled teas like "Oriental Leaf" after being left open for a few days. These "tea fungi" can apparently grow to the size of a ping-pong ball, and aspiring cultivators share "guides" on how to encourage their growth—often simply by leaving an open bottle in a warm, dark place like a car.

What to Know About Death Caps, *cont. from page 1*

An unusually rainy season has created particularly favorable growing conditions for the mushrooms, as was the case in December 2016, when state officials reported 14 cases of Death Cap poisoning. All of the individuals survived, but three required liver transplants and one child had "permanent neurologic impairment."

Death Caps may thrive in California, but they are not limited to the state. The highly poisonous species is responsible for 90 percent of mushroom-related fatalities worldwide.

Death Cap sightings and poisonings have been reported across the Midwest, Northeast, and Mountain West in recent years. Most recently, in October, the Idaho Department of Health and Welfare reported that the "world's deadliest mushrooms" had been spotted in Boise.

Where Do Death Caps Grow?

Death Cap mushrooms, or *Amanita phalloides*, originated in Eurasia but are now found in many other places, including North America and Australia—where they were implicated in a high-profile mass murder case earlier this year. (The U.K. conservation charity Woodland Trust says they have been an "invisible murder weapon for millennia," blamed in the deaths of Roman Emperor Claudius in 54 AD and Holy Roman Emperor Charles VI in 1740.)

They are thought to have arrived in Central California in the 1930s by accident, via the roots of imported European oaks, and have taken hold across the state—and beyond—in the decades since.

"It's intriguing because it's from one place, and it's spreading in another place," Anne Pringle, a mycologist at the University of Wisconsin-Madison, told NPR in September, pointing to Northern California as a Death Cap "hot spot."

Death Cap mushrooms typically grow near pine, oak, and other hardwood trees, often in widely spaced groups. They tend to be more common in urban and suburban wooded areas, as opposed to forests.

"They're just inherently around places where people are," Britt Bunyard, a mycologist and editor-in-chief of *FUNGI Magazine*, told member station KQED.

That makes them a significant threat to people and pets, especially considering they don't look too different from other kinds of harmless mushrooms.

What Makes Them So Poisonous?

Death Cap mushrooms are similar in appearance and taste to other edible varieties, like puffballs, especially in their young "button" stage.

They are typically medium-to-large in size—growing up to 6 in. across and 6 in. tall—with a greenish-gray cap that is initially dome-shaped but flattens out over time. They have white gills, a white ring around the stem, and a large white sac at the base of the stem.

Bunyard says the Death Cap mushroom actually smells and tastes "quite nice," leaving "no hint that it's poisonous in any way."

But they got their name for a reason.

Eating half a cap or less could be enough to kill a person, with the mortality rates after ingestion reaching as high as 50 percent.

While Death Cap mushroom poisonings are hard to track, some scientists estimate that they cause about 10,000 illnesses and 100 deaths around the world each year.

What Happens After Eating Them?

Death Cap mushrooms produce a highly toxic peptide called α-Amanitin, or AMA, which is resistant to heat, cold, drying, freezing, and stomach acid.

The Food and Drug Administration (FDA) says AMA poisoning is characterized by the delayed onset of symptoms, starting on average after six to 15 hours, but potentially up to 48 hours. They manifest in sudden stomach pain, persistent vomiting and watery diarrhea and extreme thirst that may only last a day.

"If this early phase is survived, the patient may appear to recover for a short time, but this period generally will be followed by a rapid and severe loss of strength, prostration, and restlessness caused by pain," the FDA says.

It explains that the disease causes "irreversible" liver, kidney, cardiac, and skeletal-muscle damage, often ending in a coma and death after four to eight days.

"If recovery occurs, it generally requires at least a month and is accompanied by enlargement of the liver," the FDA adds.

There are few effective treatments for Death Cap poisoning. Doctors tend to treat symptoms by administering activated charcoal, large doses of penicillin, and a newer drug called silibinin, as well as rehydration and, in some cases, liver transplants.

But recent discoveries have offered hope for a potential antidote. In 2023, Chinese and Australian researchers revealed that they found the FDA-approved medical dye ICG effective in treating AMA poisoning in mice. But without human trials, it's not entirely clear how well the drug works in treating people with Death Cap poisoning.

That's why California health officials want people to eat only mushrooms from reputable commercial sources—and, if they do start having symptoms, go to a hospital immediately.

Identfying features of Amanita phalloides.

Amanita's Curse

'neath ye olden oak
on mossy ground
lies hidden caps
bring death if found
by forest watch
silver beaked owl
leave death caps be
else lose thy bowel.

—Treepower34

RESEARCHERS UNCOVER HOW A KILLER FUNGUS QUIETLY INVADES THE BRAIN

Shantell M. Kirkendoll

https://medschool.duke.edu/, Dec. 11, 2025

A deadly fungus known for causing severe brain infections in people with weakened immune systems may be sneakier than scientists realized, according to a Duke University School of Medicine study.

Cryptococcus causes hundreds of thousands of infections each year and is a leading cause of death among people with HIV/AIDS. The fungus can reach the brain just one day after entering the bloodstream, but the brain's front-line defenders—microglia—remain largely inactive for nearly two weeks.

"Microglia eventually do respond, but they wake up far too late," said the study's lead author Mari Shinohara, Ph.D., senior study author and professor in the Department of Integrative Immunobiology.

The work, funded by the National Institutes of Health with support from the Duke SOM Precision Genomics Collaboratory-OBGE Graduate Student Pilot Research Grant, points to a surprising vulnerability in the brain's immune defenses.

In their study, reported in *Cell Host & Microbe*, Shinohara and postdoctoral researcher Estefany Reyes, Ph.D., used mouse models to show that microglia struggle to detect the fungus on their own. Instead, they depend on T-cell signals, including the molecule interferon-gamma, to sound the alarm.

By the time microglia do respond, they release large amounts of osteopontin, a protein that may worsen the infection.

"Because microglia can play both helpful and potentially harmful roles, understanding how to guide their responses will be important," Shinohara said.

The findings reveal a fungus that thrives by exploiting the brain's slow-to-react immune landscape, and they hint at new strategies for treatment. While antifungal drugs directly target the pathogen, Shinohara said the study suggests a complementary path: adjusting the brain's own immune response.

"In the future, pairing antifungal drugs with approaches that gently modulate microglial activity may offer better outcomes for people with cryptococcal meningitis," she said.

Her team now plans to identify the exact signals that rouse microglia and explore how to encourage protective responses without triggering harmful inflammation.

MELZER'S REAGENT AND A SUBSTITUTE

Dick Sieger

Melzer's reagent has been an important aid for identifying fungi since its introduction in 1924 by Václav Melzer, a Russian *Russula* specialist. It is a mounting medium for microscope slides and is used in the studies of Ascomycetes and Basidiomycetes. Mycologists Alexander Smith and Meinhard Moser even applied it to fresh mushrooms.

Melzer's changes the color of some mushroom tissues. That can be a great help in identifying a genus or a species. Colorless cells that contain starch or starch-like compounds become a blue-gray color. That's called an amyloid reaction. Other cells containing glycine betaine become reddish-brown, a dextrinoid reaction. And of course the absence of a color change is also diagnostic. Some features of mushrooms are highlighted by an amyloid reaction, such as the beautiful patterns on the surface of *Russula* spores.

Melzer's is an aqueous solution of iodine, potassium iodide, and chloral hydrate. And there's the rub. Chloral hydrate is a Schedule IV controlled substance that has been involved in date rape. It is most difficult to obtain anything containing it. Hobbyists' schemes to get Melzer's—begging mycologists, ordering from Europe, putting the arm on a fortunate friend, getting a physician's prescription—are rarely successful. But I discovered an open secret. Lugol's solution! Used in mycology for at least 30 years, it has escaped the attention of many of us.

Lugol's is simply Melzer's without the chloral hydrate. Chloral hydrate is a clearing agent that helps make mushroom tissue visible but it certainly isn't necessary. Other mounting media that we use are not clearing agents and they work just fine.

Michael Beug, a mycologist and chemist, writes in his *Mushrooms of Cascadia*, "Lugol's can also be useful for Basidiomycetes if you cannot obtain Melzer's solution." René Dougoud's *Studying the Discomycetes* and Marcel Lecomte's *Microscopy & Fungi* recommend its use. Melzer's and Lugol's have occasional differences in their behavior but that shouldn't be a concern for us.

Best of all, 2 percent Lugol's in a dropper bottle has some medical applications, so it's readily available in pharmacies and online for a modest price.

SOIL BACTERIA AND FUNGI EMERGE AS A TOP PREDICTOR OF CHILDHOOD ALLERGIC DISEASE

https://news.agu.org/, Dec. 15, 2025

NEW ORLEANS - The unique blend of fungi and bacteria in a region's soil may be the strongest factor explaining its rates of childhood allergic disease, with certain assemblages of soil critters appearing linked with better health outcomes, according to new research to be presented at AGU's 2025 Annual Meeting in New Orleans. Although a causative connection has yet to be established, the researchers say the pattern appears with remarkable consistency across the globe.

"We've analyzed the data in every way we can think of—adding datasets, looking at different measures of [soil] diversity… but no matter how we've done it, this result is consistent," said Joshua Ladau, a microbial ecologist involved in the research and working at Arva Intelligence, a farmer-focused environmental solutions company. "At this point, I'm exceedingly confident this association is real."

Ladau will present his research on 16 December at AGU25, joining more than 20,000 scientists discussing the latest Earth and space science research.

A Global Question

Allergic disease affects an estimated 2.5 billion people worldwide, or roughly 30 percent of humanity. A growing body of research indicates that exposure to a diversity of soil microbes, especially in childhood, can help limit allergic disease—potentially by helping us develop immune tolerance early in life, experts hypothesize. However, how much this matters in comparison to other influencing factors remains unclear.

"When you compare the effects of beneficial microbes with things like access to health care, genetics, climate, and pollution, how do they stack up? That was our question," Ladau said. "Soils are not generally the things people point to first when thinking about health."

To dig into this, the team drew on datasets recording the prevalence and severity of atopic dermatitis, asthma, and allergic rhinitis among over a million children in over 250 cities across 97 countries, plus three global surveys of soil fungal and bacterial diversity amounting to over 8,200 soil samples from around the globe. They then used a model to tease out the associations between the disease rates and soil biodiversity represented in the data.

The sheer volume of information made this a daunting task. Just preparing the massive datasets for analysis took many months, Ladau said. And the soil samples didn't always come from the exact same locations as the allergic children, requiring the researchers to develop a mathematical method to account for the distance between them when drawing connections. Even so, Ladau said, "the fact that we're seeing such a strong signal despite this mismatched dataset points to how important the microbial measures are in predicting allergic disease."

On top of that, each soil sample contained thousands of microbial taxa, making it difficult to determine which ones were actually associated with lower rates of allergic disease. But having carried on this project since 2022, Ladau said his team is starting to figure it out. Based on their model, soil microbes are the most important predictor of regional differences in allergic rhinitis and asthma, in terms of both disease prevalence and severity. Compared to already-known predictors of allergic disease like climate, wealth, and demographics, soil microbes are up to four times more predictive than the next most important variable.

(Microbial) Community Matters

Crucially, simply having a broader diversity of microbes doesn't seem to matter. Instead, it's all about which microbes a soil has. "It looks like there are a number of taxa that are promoting health, and ones that are negatively associated, which makes sense—not everything out there is good," Ladau said. What's more, he added, those negative ones weren't already known as pathogens, adding to the novelty of the discovery.

This doesn't prove that soil microbes are causing kids to have less allergic disease, only that the two seem to go hand-in-hand. But so far, Ladau said, no other factor has emerged that accounts for that link.

Besides establishing whether the connection is causative, Ladau would like to investigate ways to promote public exposure to potentially healthful soils. This could happen through encouraging people to spend more time outdoors, but also through policies and land management strategies aimed at conserving and restoring soils—which can also improve soils' ability to sequester carbon, remediate fire damage, decompose detritus, and control pest prevalence. Human health only adds to that list of boons, Ladau said.

"Linking soil biodiversity to public health provides a major additional facet to the importance of soils and what's living in them," he said.

FUNGI FED ON CARROT SCRAPS OUTPERFORM SOY IN BLIND TASTE TESTS

https://scienceblog.com/, Dec. 17, 2025

Every year, the food coloring industry discards thousands of gallons of liquid left over from processing carrots. German scientists decided to feed that waste to fungi. The result: a protein-rich ingredient that blind taste testers actually preferred over soy-fed fungi.

The study, published in the *Journal of Agricultural and Food Chemistry*, screened 106 fungal strains to find one capable of transforming carrot side streams into something people would want to eat. The winner was *Pleurotus djamor*, the pink oyster mushroom. Grown in submerged fermentation tanks on nothing but liquid carrot leftovers, this fungus produced dense mats of mycelium, the root-like network that forms the organism's main body. Fresh, it smells neutral to savory and has a fibrous structure that mimics the chew of animal meat without any engineering.

When the team used this mycelium to make vegan burger patties, replacing soy protein entirely, untrained volunteers rated the fungal version higher on texture, smell, and overall appeal. Testers described the mushroom-based patties as softer and less dry, with fewer bitter notes. The sausage trials told a similar story. Compared against chickpea-based versions, the mycelium links earned higher marks for umami depth and a more satisfying bite.

J. Agri and Food Chem. 2025, DOI: 10.1021/acs.jafc.5c11223

Taste testers preferred patties (left) and sausage-like links (right) made from fungi grown on carrot side streams to similar versions made with more traditional plant-based proteins.

PSYCHEDELIC TREATMENTS SHOW PROMISE FOR OCD WHILE CANNABIS DOESN'T, REVIEW FINDS

Hannah Harris Green

https://www.theguardian.com/, Dec. 13, 2025

A recent review of alternative treatments for obsessive compulsive disorder (OCD) indicates that psychedelic treatments show promise for the disorder while cannabis does not.

Dr. Michael Van Ameringen, a psychiatry professor at McMaster University in Ontario, Canada, and lead author of the review published in the *Journal of Psychiatric Research*, said that 40–60 percent of OCD patients get either partial or no relief with available treatments, including SSRIs and exposure and response prevention therapy.

While psychedelics and cannabinoids have become part of the conversation surrounding OCD—a disorder characterized by intrusive, obsessive thoughts and/or compulsive behaviors—there is a much larger body of published evidence on the efficacy of these substances for more common conditions, like depression and anxiety.

"We wanted to hone down and really understand, is there evidence for these things that have been talked about to be used as the next step treatments?" Van Ameringen explained.

Given the paucity of existing literature, Van Ameringen said he didn't know what to expect. To make up for the lack of published information, he included conference presentations and preliminary, unpublished findings in the review paper.

Upon compiling available evidence, Van Ameringen and his team found "stronger signals" for the efficacy of psychedelics, specifically psilocybin (the psychoactive component of "magic mushrooms") than for cannabinoids like THC and CBD.

Van Ameringen theorizes that the difference is related to how these substances interact with areas of the brain related to OCD. While cannabinoids activate the brain's CB1 receptors, which regulate symptoms like compulsions and anxiety, available evidence shows they don't offer lasting relief from OCD symptoms.

Psilocybin, on the other hand, can reduce connectivity in the brain's default mode network, which "essentially is involved in self referential thinking and rumination. The default mode network is really activated in OCD," he says.

A difference in the methodology of cannabis and psilocybin studies might also have contributed to the different results, says Dr. Mohamed Sherif, a psychiatrist and computational neuroscientist at Brown University who will lead a future clinical trial on psilocybin for OCD. Psychedelic clinical trials, like the one Sherif is planning, tend to offer patients not only medication but also encouragement to frame their experience as a therapeutic "journey."

"This was not done in cannabinoids [studies,]" Sherif explained.

Dr. Terrence Ching, a clinical psychologist at the Yale School of Medicine, similarly wondered if the way people use cannabis versus psilocybin might explain the different outcomes. While people tend to use cannabis for temporary relief, psilocybin can help facilitate actual changes in the brain and in patients' perception of their OCD.

"One could use cannabis for the same therapeutic reason, of confronting something deeper about their OCD or their obsessive fears. But conventionally, people tend to use cannabis for an avoidance function," Ching explained.

Preliminary results from Ching's clinical trial on a single dose of psilocybin for OCD were included in Van Ameringen's review paper, and showed that psilocybin was effective for OCD symptoms compared to placebo. Ching is now preparing the results of the trial for publication, and planning a second clinical trial where OCD patients will receive two doses of psilocybin at different times.

DNA CAUGHT ON OLD AIR FILTERS REVEALS HIDDEN PAST OF ECOSYSTEMS

Sara-Lena Brännström

https://phys.org/, Dec. 18, 2025

DNA captured on air filters stored since the 1960s acts as an ecological time capsule, according to a recent article in *Nature Communications*. The findings show that tiny fragments of genetic material can paint a detailed picture of life across the landscape. They also reveal a distinct decline in biodiversity over three decades.

All organisms shed cell fragments with DNA to the environment. Now, researchers have performed the largest and most detailed analysis to date of airborne DNA using filters originally used to monitor radioactive fallout.

Air-monitoring filters are found at hundreds of sites worldwide. These particular filters came from a station in northern Sweden, and had been archived in a basement at the Swedish Defense Research Agency since the 1960s. When researcher Per Stenberg learned about the archive about a decade ago, he and colleague Mats Forsman realized what a goldmine it was.

Week after week, the filters collected DNA from all living things: plants, fungi, insects, microbes, birds, fish, and even large mammals like moose and reindeer. By sequencing the DNA, the research team was, on a weekly basis, able to identify the presence of 2,700 organism groups within several miles of the station and track how their populations increased or decreased over 34 years.

"It was a stroke of luck that the filters had been kept—and that they were made of a material that preserves DNA. The archive turned out to be a time machine, allowing us to revisit the past and watch an ecosystem changing in almost real time," says Stenberg, lead author of the study conducted by researchers from Umeå University, the Swedish University of Agricultural Sciences, and the Swedish Defense Research Agency.

When the researchers looked at long-term patterns, they saw a clear decline in biodiversity in the area, from the 1970s to the early 2000s. Examples of declining organisms include birch together with wood-associated lichens and fungi. The overall decline cannot be explained by changes in the climate, but rather seems to be linked to human activities such as forest management.


Happy New Year!