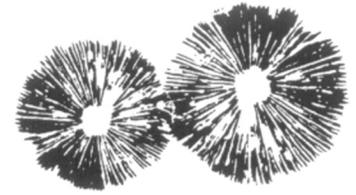


SPORE PRINTS



BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY
Number 456 November 2009

CHEMICAL SECRETS OF THE MATSUTAKE MUSHROOM

William Wood

Wisconsin Mycological Society



Mushroom hunters know how hard it is to find the elusive matsutake. They hide in the forest duff, just peaking out with a small portion of their cap or only showing as a hump in the ground cover. In spite of their secretive nature, they are actively sought out by amateur and commercial pickers because of their exquisite taste and high commercial value.

Because of its unique flavor, the matsutake has been revered for hundreds of years in Japan and has become deeply ingrained in the culture. In recent years, the harvest of the Japanese matsutake [*Tricholoma matsutake* (Ito et Imai) Sing.] has declined and so the American matsutake [*Tricholoma magnivelare* (Peck) Redhead] is imported to fill the gap.

The chemicals that make up the exquisite taste of this mushroom have been the focus of many scientific studies on the Japanese species. In fact, the very first studies as to the compounds responsible for odors in mushrooms were done on extracts of Japanese matsutake. In 1936 and 1938, Japanese scientist S. Maruhashi isolated and identified two highly odoriferous compounds from matsutake extracts. The substance most characteristic of the distinctive odor of the matsutake is the ester, methyl cinnamate. Esters are pleasant smelling compounds and are found in many edible fruits. In this case the ester is related to the compounds that give cinnamon its spicy flavor, hence the origin of the name “cinnamate.”

The other compound that Maruhashi identified as being important to the flavor of the matsutake was an alcohol. This compound has been dubbed “mushroom alcohol” because it is found in many other mushroom species. The proper chemical name for this alcohol is 1-octen-3-ol, and it is responsible for the typical mushroom odor.

A recent scientific study explains why these two pleasant tasting compounds are found in the matsutake. In the September issue of *Biochemical Systematics and Ecology* [35: 634–636 (2007)], William Wood and Charles Lefevre report the production and function of these substances in the American matsutake. The spicy ester, methyl cinnamate, is a potent slug repellent. The matsutake uses this compound defensively to protect the sporocarp from being eaten by slugs before it can release its spores.

The second compound, the “mushroom alcohol,” is even more interesting. When Wood and Lefevre extracted mushrooms that were not cut up or crushed, they found this “mushroom alcohol” was absent. If they crushed the mushroom before their analysis, a large amount of this chemical was formed. This is a second and equally potent way the matsutake protects itself from slug predation. Previous research by William Wood has shown that “mushroom alcohol” is a potent banana slug repellent (*Biochem.*

Syst. Ecol., 29: 531). When a slug tries to eat a mushroom, the chewing causes this alcohol to be released, which repels the slug. It is interesting that these two chemicals, which humans find as flavorful, are in reality produced by the mushroom to protect them from slug predation.

Besides looking into the chemicals produced by the fruiting body or sporocarp, these researchers investigated the chemicals found in the mycelium of the American matsutake. This mushroom is mycorrhizal and only grows in association with the roots of trees. In this association, the trees exchange sugars produced in their leaves for nutrients collected by the mycelium from the soil surrounding the tree roots. Because of this special mutualistic or symbiotic arrangement these mushrooms cannot be artificially grown and harvested.

cont. on page 5

UPCOMING FIELD TRIP

Brian Luther

Nov. 7 Nisei Veterans Invitational Mushroom Foray
CANCELLED

CANCELLED!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

Some time ago we were contacted by a group of retired Japanese-American veterans who wanted the chance to collect matsutake. Marian Maxwell, Patrice Benson, and John Goldman planned this outing in their honor. We’re calling it the Nisei Veterans Invitational Mushroom Foray. Let’s hope for a good fruiting of matsutake while we’re there.

The campground is in a wonderful area of older growth forest. Only rustic amenities are available (pit toilets and no running water), so please be prepared and plan accordingly by bringing extra water and hand soap. This is a day trip only, as the campground will be closed.

Things to keep in mind: (1) *A NW Trailhead Pass or daily trailhead permit (\$5.00) is required*; if you don’t already have one, you’ll need to stop at the Forest Service Ranger Station and buy a daily permit. (2) *If you’re going to collect fungi, you must have a Forest Service collecting permit*, and you must obtain it during the work week. Even though the ranger stations are open on Saturdays, they *do not* issue collection permits then. Also, parking might be somewhat limited, requiring you to find a spot that’s not as convenient as at most locations.

PSMS has been having fall field trips at this site since the late 1960s and it’s definitely an “old friend,” but we have not been there in a long time. *Identifiers*: Brian Luther, Marian Maxwell, Patrice Benson.

Directions: CANCELLED

Matsutake galore. Don't you wish!



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

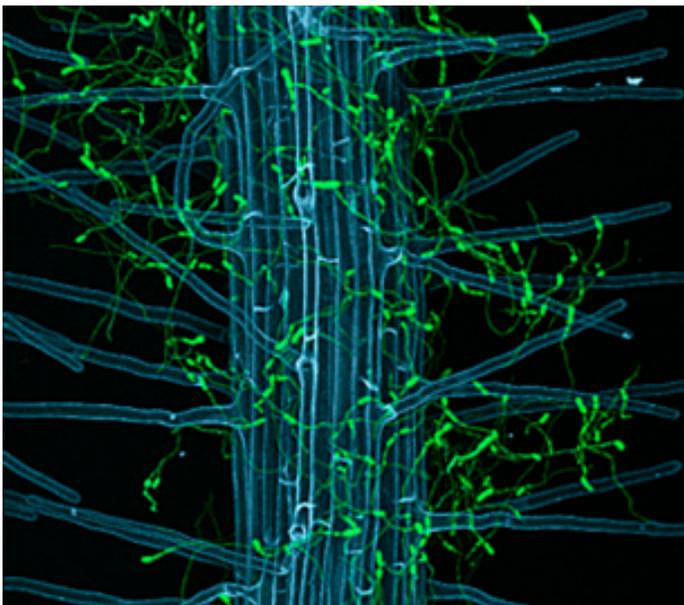
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CALENDAR

- Nov. 7 Nisei Veterans Invitational Mushroom Foray,
CANCELLED
- Nov. 10 Membership Meeting, 7:30 p.m., CUH
- Nov. 16 Board Meeting, 7:30 p.m., CUH
- Nov. 17 *Spore Prints* deadline
- Dec. 8 Membership Meeting, 7:30 p.m., CUH



"Fungal Infection of Arabidopsis (a flowering plant) Root" by Kirk Czymmek won an honorable mention in the 2009 Nikon Small World Competition.

MEMBERSHIP MEETING

Milton Tam

Tuesday, November 10, 2009, at 7:30 p.m. at the Center for Urban Horticulture, 3501 NE 41st Street, Seattle.



Our speaker for November will be Dr. Tom Volk, known for his dry humor and many interests. The title of his presentation is "Spores Illustrated." Tom is Professor of Biology at the University of Wisconsin-La Crosse, where he teaches a number of courses including General Mycol-

ogy, Medical Mycology, Plant-Microbe Interactions, Advanced Mycology, Food & Industrial Mycology, Organismal Biology, Latin & Greek for Scientists, and Plant Biology. He is currently enjoying a well-deserved sabbatical year off from his teaching duties and will be spending some time with us in the Northwest this fall. He was the 2003 recipient of the Weston Award for Excellence in Teaching Mycology, awarded by the Mycological Society of America, and was the 2005 recipient of the Award for Outstanding Contributions to Amateur Mycology by the North American Mycological Association (NAMA). He created and maintains an internet page (<http://TomVolkFungi.net>) that contains links to Images for Teaching Mycology, 1000+ downloadable images of fungi from all taxonomic groups, and that also features a "Fungus of the Month" as well as an extensive introduction to the Kingdom of Fungi. He is widely published and his diverse research interests include *Armillaria*, *Laetiporus*, *Bridgeoporus*, *Morchella*, medically important fungi, fungal ecology, bioremediation with fungi, and fungal biodiversity,

If your last name begins with the letters L-Z, please bring some goodies to share after the meeting.

SODA SPRING FIELD TRIP REPORT Brian Luther

When I arrived at the campground a little before 4:00 p.m. on Friday, September 25, it was empty except for a few campers, so I had no trouble grabbing onto our favorite shelter by the foot bridge and reserving it for Saturday. This is by far one of my favorite locations. The beautiful setting along Bumping River, the large, sturdy foot bridge going across directly into the William O. Douglas Wilderness, the highly carbonated, iron-rich water bubbling out of the ground nearby (you have to taste it at least once!), the wonderful old CCC shelters, and the isolation make this a special place to hold a field trip, and it's well known to long-time members of PSMS. The deep conifer forests with an unusual mix of Douglas Fir, Western Hemlock, Grand Fir, Western Red Cedar, Western Larch, Engelmann Spruce, Lodgepole Pine, and Western White Pine provide for a plethora of mycorrhizal fungi, when conditions are favorable.

But conditions were quite dry and I was also unable to find anyone willing to host. In addition, the Forest Service had turned off the water to the campground as well. Despite these disadvantages we had a great outing. Knowing I had no host, I stopped at Safeway in Seattle at the last minute and at least picked up some fresh bagels and cream cheeses and some half-gallon cartons of orange juice, so the members would have a little something on Saturday morning when they showed up.

Marian Maxwell was planning on assisting me with ID, but she and her husband, Scott, had an unfortunate experience with some

fresh wet concrete they were pouring, putting both in the ER. We wish Marian and Scott a full recovery! As a result, I thought I would have the burden of ID all by myself, but that was not the case. Even though we had no host and conditions could have been more desirable, two people in particular provided much needed assistance and support for which I am deeply grateful. First of all, Doug U-Ren was already at the campground with his truck and trailer. Doug had been camping there for a week prior and checking on the conditions, and he was able to give me a really current update on what was fruiting. Doug also provided needed logistic support including a powerful portable generator, allowing us to get a small coffee pot going, use a toaster I had brought, and charge cell phones. He also had a large stock of potable water in his RV, so we ended up having a good supply for the weekend after all. Then about mid-day on Saturday I was very glad to see Hildegard Hendrickson show up. She offered much needed help with ID all day and also made sure I focused on getting labels made, without too many distractions. Without Doug and Hildegard's help, the field trip would not have been nearly as enjoyable for the members. Thank you, Doug and Hilda, for your excellent assistance in so many ways!

The days and nights were truly beautiful—sunny warm days and completely clear, cool nights with an unprecedented view of an infinite selection of stars and constellations. Fall was definitely “in the air.” It got dark right around 7:00 p.m. and because of the high mountains all around it wasn't really light until a full 12 hours later.

Nineteen members signed in, and it was a pleasure to meet several new members, some of whom were taking the Beginner's Class. We got surprise visits from former President Kern Hendricks (1990–92) and member Bill Bridges—people I hadn't seen in along time.

Even though general forest conditions were dry, there were many places where the soil was more moist, especially near or along the river, in drainage areas of draws, and in other low lying spots near pools and ponds or seepage areas. At first glance and with a brief walk through the forest with the ground going “crunch” under foot, you would anticipate hardly any fungi. But as is always the case, when you get a large group out in the woods, going to many different locations and looking carefully, it's amazing the diversity of fungi that are brought in.

Most everybody found at least a few White Chanterelles (*Cantharellus subalbidus*) with diligent searching, and some were lucky enough to get *Boletus edulis*. Several non-PSMS families camping there were interested in our endeavor, and promptly went out looking for mushrooms to get identified. One family went across the bridge to a place all of us had been by numerous times and to our dismay came back with a basket full of the most beautiful, prime *Boletus edulis*—all in perfect condition. I guess we'll have to say this was genuine “beginner's luck.”



Some White Chanterelles (*Cantharellus subalbidus*) found at Soda Springs.

Ninety-six different species were collected, identified, and displayed along the edges of the shelter and on a separate table. Six species of *Suillus* were found: *S. caerulescens*, *S. lakei*, and *S. grevillei*, in particular, were quite plentiful. Hildegard brought in several very nice *Suillus luteus*, definitely the best of the genus for

eating. She also found one small matsutake (*Tricholoma magnivolare*) which was (until Sunday) the only specimen of this species found by members. All three color varieties of *Amanita muscaria* came in, which is highly unusual for one field trip. Rare or unusual taxa included *Arrhenia (Omphalina) epichysium*, *Megacollobybia (Tricholomopsis) platyphylla*, *Pluteus petasatus*, along with *Albatrellus confluens*, *A. avellaneous*, and *A. ellisii*. Without a doubt, little *Hygrocybe miniata* won the award for the prettiest find of the weekend.



Hygrocybe miniata

A Douglas Squirrel was seen stealing some of our mushrooms on display, but also came back to eat a noticeable section of watermelon left on one of the tables.

Doug and I went out for about an hour early Saturday morning with his truck and loaded up on firewood. I had brought some from home, but with the huge fireplace in the shelter, it didn't last long. This kept a big steady fire going in the hearth all weekend, and it was appreciated for the meal on Saturday.

About ten people stayed for a really pleasant potluck in the shelter, starting about 5:00 p.m. but going well after dark. Lisa Ramey had made some pumpkin cookies (out of fresh pumpkin) coated lightly with real maple syrup frosting, and they were out of this world. Doug shared a large platter of home smoked salmon he had caught. There were lots of other dishes and wine. Everything was good, but you know how food tastes better out in the woods, for sure!

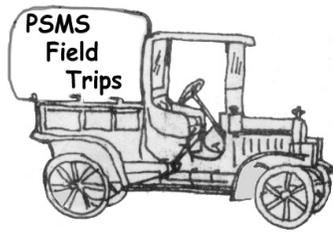
In the past I've rarely gotten the chance to do collecting on my own because of my ID responsibilities and having to go home to get ready for work on Sundays. But now that I'm retired I was able to go out on Sunday morning, all by myself, with no other obligations and collect in a leisurely fashion for four hours. What a pleasure! I hiked a mile through very dense woods following the river, and my efforts were worth it because I found two matsutake and then ran across a windfall of very large, meaty White Chanterelles in perfect condition. I didn't have a large bucket with me, and after collecting all I could find and properly trimming and brushing them, I was out of room. So, I filled lunch-sized paper bags with the rest of my booty and then had to put three of these stuffed inside my shirt, loosely buttoned, otherwise they would have stayed in the woods. When I got back Doug took a picture of me bulging in front, but I assured him I was not pregnant.



Who, me? What mushrooms?

It was a small group, overall, but very enthusiastic. Doug stayed and helped me gather the specimen cards, return the specimens to the woods, and clean up the shelter on Sunday afternoon. We were the last to leave about 4:30 pm.

On Sunday, Oct. 11, Hwy. 410 was closed at Chinook Pass for people going east because of a massive landslide west of Naches. If this had happened a couple weeks and a day earlier, we would have been prevented from having our Soda Springs field trip. It is not clear to me why they did not allow access to the recreation areas below Chinook Pass when the slide was 40 miles away, but maybe it was easier than asking all the eastbound drivers where they were headed? It is true that most of the eastbound traffic over Chinook Pass is going to Yakima or destinations farther east.



For our field trip on October 10, Jack Hartt, the manager of Deception Pass State Park, had given me the choice of either shelter at Bowman Bay, and our hosts, Becky and Steve McIntyre, selected the one closest to the water—a beautiful spot for the day. Steve and Becky

were already set up by the time I arrived at 8:20 a.m. Steve roasts his own coffee, buying the beans in bulk, and we were treated to some of the most delicious coffee we've ever had at a field trip. To some people, coffee is coffee, but to many of us, you can definitely tell the difference. Of course, there were lots of muffins and bagels and other munchies to go along with the great coffee. Thanks, Becky and Steve. Everybody appreciated your efforts! John and Ruth Haines brought a big crock pot of delicious, hearty soup, and I had gotten up at 4:00 a.m. and made a big pot of homemade minestrone which I brought in a crock pot as well.

Sixty-one people signed in, a surprising number considering the very dry conditions. At 10:00 a.m. I gave a brief lecture and passed out my two-page info sheet on collecting in Washington State Parks and discussed proper collecting equipment and habits.

I was very pleased to see PSMS charter member Russ Kurtz walking down from the parking lot, and it was great to have a chance to talk. Russ is one of only two remaining charter members, himself and Joy Spurr. Former President Margaret Dilly and her sidekick, Claude, also showed up. Claude and Margaret have been active in PSMS almost forever (which is a really long time), and they live in Oak Harbor, very close to the field trip site. Margaret helped a lot with identification, for which I am grateful. During the day Russ Kurtz came back with a perfect old bird's nest he had found. As most of you know, Bird's Nest fungi are very common—but the one he found was quite unusual—it's never been seen in the wild before.

Ninety-three different species were collected and displayed, which is pretty good considering the conditions. *Suillus caeruleus* was the most frequently collected mushroom because of the abundance of its mycorrhizal tree symbiont, Douglas Fir.

Only a few Chanterelles (*Cantharellus formosus*) were found, but lots of *Chlorophyllum* was brought in, a couple of different species. Two rare or interesting species were found. One, a perfect button of *Boletus pulcherrimus*, a bolete



Boletus pulcherrimus in a bird's nest.

with a large, ventricose (swollen) dark red stem with prominent reticulations on the upper half, tubes that are blood red, and flesh that is pale yellow but rapidly stains blue. It's intensely bitter and poisonous. At maturity it gets very large. Second, a conk (*Fomitopsis pinicola*) was collected that was parasitized by the bright orange Pyrenomycete *Hypomyces aurantius*. This species attacks only polypores.

The potluck was at 3:30 p.m., and I think everybody was hungry, because we pretty much picked it clean like vultures. Not a lot of mushrooms, but a great day and a good excuse to get out.

When it comes to keeping a log of mushroom expeditions and findings here's a surprising idea—keep your secrets online in a blog! We've all heard of blogs and some of us might even have experience with them. They're a way to keep a web log (the name "blog" comes from the last letter of "web" and the word "log" of your experiences. I've used them to record travels (jackinchile.blogspot.com) and now I'm using a blog to keep my mushroom secrets.

After every mushrooming trip I come home and write up a report. I include what fungi I discovered, a specific description of the location with landmarks to help remind me the next time I'm in the area (often including pictures of exactly where I left the trail to find my treasure trove of fungi), GPS coordinates, and anything else I found of interest including what I might want to do in the future ("try this location a couple weeks earlier for boletes"). I can easily go back and read about past trips and plan my next foray. I can even add multiple "labels" to each posting (something like "chanterelle" or "morel" or a location name) and then in the future ask to review all of the postings that include that label—this is especially handy when plotting out a new season's expeditions.

You might think this is a crazy idea: "Anyone in the world can read blogs—you'll give away all of your secrets!" *Au contraire*. The free blogs on blogspot.com can be set up so that only the author (me!) can read them. It's ideal for keeping secret mushroom locations secret.

Here's how it's done. Go to www.blogger.com and sign up by clicking on the big orange "Create a Blog." It's free and very simple.

Then it's a simple step-by-step process (the hardest part might be finding a name—"jack's_secret_mushroom_spots.blogspot.com"—for your blog that no one else is using) and in a matter of minutes you have your blog!

But before you write a single entry, there are a couple important security measures that you need to take.

First go to the upper right hand corner of your new blog and select "customize—settings—basic." There you need to select "No" for "Add your blog to our listings" and also "No" to "Let search engines find your blog." That will keep your blog away from the prying eyes of search engines.

Next go to "customize—settings—permissions" and under "Blog Readers" select "Only blog authors" for the allowed readers. That keeps the prying eyes of anyone that might be able to guess your blog name from seeing your blog. They will get a message stating that this is a private blog. Exactly what you want!

And to prove it, here's the address for the blog that has all of my secret locations (including GPS data!): oolonmushrooms.blogspot.com. Give it your best shot—I don't think you'll have any luck reading my blog and discovering all of my secrets.

PENIS-SHAPED MUSHROOM NAMED AFTER FROG EXPERT

Brendan Borrell

ScientificAmerican.com, June 15, 2009

Herpetologist Robert Drewes will forever be remembered for his two-inch *Phallus*.

In the upcoming issue of the journal *Mycologia*, scientists describe a new species of stinkhorn fungus from Africa, which they christened *Phallus drewesii* in honor of their expedition leader.

“I am utterly delighted,” Drewes told the San Jose *Mercury News*. “The funny thing is that it is the second smallest known mushroom in this genus and it grows sideways, almost limp.”



As the California Academy of Sciences’ curator of herpetology, Drewes has spent his career wrangling snakes and chasing after frogs. Since 2001, he has been leading scientific expeditions to the sparsely populated islands of São Tomé and Príncipe off the coast of West Africa, home to hundreds of plant and animal species found nowhere else on earth.

In 2006, he made the mistake of bringing along his longtime friend Dennis Desjardin, a mushroom expert at San Francisco State University who recognized the phallic fungus sprouting from a piece of wood as new to science. Stinkhorns like *Phallus drewsii*, are found mostly in the tropics, and their characteristic shape helps them emit an odor of dung or carrion that attracts flies to disperse their spores. The stinkhorn was one of 225 fungus species that expedition scientists collected during two trips to the region, and it is the third species named after Drewes, who also has a snake and a frog to call his own.

NEW GLOWING MUSHROOM SPECIES NAMED AFTER MOZART’S REQUIEM Elaine Bible

San Francisco State News, October 7, 2009

SF State Professor of Biology Dennis Desjardin has discovered seven new glow-in-the-dark mushroom species, increasing the number of known luminescent fungi species from 64 to 71. He has named two of the new species after movements in Mozart’s Requiem—*Mycena luxaeterna* (eternal light) and *Mycena luxperpetua* (perpetual light)—names which reflect that the mushrooms glow 24 hours a day.



Mycena luxaeterna by day (left) and by night (right).

Desjardin and colleagues discovered the fungi in Belize, Brazil, the Dominican Republic, Jamaica, Japan, Malaysia, and Puerto Rico. The discoveries include four species new to science and three new reports of luminescence in known species. Three-quarters of glowing mushrooms, including the species described in the study, belong to the *Mycena* genus, a group of mushrooms that feed off and decompose organic matter as a source of nutrients to sustain their growth.

These latest findings shed light on the evolution of luminescence, adding to the number of known lineages in the fungi family tree where luminescence has been reported.

“What interests us is that within *Mycena*, the luminescent species come from 16 different lineages, which suggests that luminescence evolved at a single point and some species later lost the ability to glow,” Desjardin said. He believes some fungi glow to attract

nocturnal animals that aid in the dispersal of the mushroom’s spores, which are similar to seeds and are capable of growing into new organisms.

To date, Desjardin has discovered more than 200 new fungi species, and together with these latest findings, has discovered nearly a quarter of all known luminescent fungi. “It’s pretty unusual to find this many luminescent species, typically only two to five percent of the species we collect in the field glow,” Desjardin said. “I’m certain there are more out there.”

Matsutake Secrets, cont. from page 1

As part of his Ph.D. studies Charles Lefevre was able to culture American matsutake mycelium in the absence of the symbiotic tree roots. These cultures were slow growing, taking a number of months to grow to a reasonable size. When these cultures were analyzed by William Wood, the chemist on this study, he found to his surprise that the slug repellent chemicals observed in the sporocarp were absent in the mycelium. The secret chemical life of the matsutake continued to unravel.

The major chemicals Wood found in the mycelium were of a type rarely found in terrestrial plants or animals; they contained organic chlorine compounds. These types of compounds are best known as substances that humans have used as pesticides, such as the insecticide DDT or the herbicide 2,4-D. Why are these compounds being made by the mycelium? This is the question these researchers asked.

The mycelium is not under threat of being eaten by slugs since it is growing underground with the tree roots. However, at this stage of the matsutake’s life cycle, there is competition with other fungi for space on the tree roots. The chlorinated compounds found in the mycelium, 3,5-dichloro-4-methoxybenzaldehyde and 3,5-dichloro-4-methoxybenzyl alcohol, are known to stop important aspects of fungal metabolism. They inhibit an enzyme that produces cell walls in other fungal species. These compounds also halt the production of fungal melanin, a pigment that protects fungal hyphae by forming a physical barrier between the cell and its surroundings. Chemical warfare between different fungi for space on plant roots is not frequently observed, but must be an important aspect of fungal life.

To exclude the possibility that these chlorinated compounds were only produced in the artificial medium in which the mycelium was grown, these researchers analyzed soil containing matsutake mycelium. They identified the most abundant of the chlorinated compounds in the soil, so these compounds are not artifacts and are produced by free-living mycelia.

Thus, the matsutake uses defensive chemicals throughout its life cycle. When it is underground and associated with tree roots, it fights off other fungi’s mycelium with exotic chlorinated compounds. On fruiting, it protects the spores in the sporocarp with the volatile and spicy ester, methyl cinnamate. Furthermore, if slugs trying to eat this mushroom are not repelled by this potent ester, it releases large quantities of distasteful mushroom alcohol upon tissue disruption.



American matsutake, *Tricholoma magnivelare*

WHY CATS CRAVE MUSHROOMS

Sue Kinnamon and Tom Finger

Spores Afield, Colorado Myco. Soc., October 2009

In the August issue of *Spores Afield* Ellen Jacobson noted that her cat “begged for boletes” and wondered whether this was a common occurrence and if so, why. Although we have only dogs—and we can’t even train them to find boletes in the forest—we can offer a reason why cats may like mushrooms.



Our desire for various foods, like that of other animals, is driven largely by our sense of taste. Taste sensations fall into two broad categories: those that drive increased intake (so-called appetitive qualities) and those that are naturally avoided, e.g., bitter. For humans, as for most other mammals, innate food preference is driven by nutritional requirements. Unripe fruit and plants containing toxins are bad; carbohydrates and protein are good. For herbivores, sodium salts are a strong nutritional need as well. Hence we have developed the ability to discriminate five taste qualities. The aversive tastes are sour (for avoiding unripe fruit and spoiled foods) and bitter (for avoiding toxic alkaloids produced by many leafy plants). Salt, which is a strong intake motivator for herbivores, is preferred by people only in moderate quantities (and becomes avoided at very high levels). Finally, the preferred qualities for humans are sweet (to identify foods rich in carbohydrates) and “umami” (Japanese for “delicious”) for detection of protein-rich foods. Dogs have similar taste preferences, but cats do not. Why?

The taste receptors for the preferred qualities of sweet and umami consist of two component molecules. For sweet, the receptor complex consists of the sweet-specific molecule TIR2 and an obligatory partner TIR3. For umami, the receptor complex is the umami-specific receptor TIR1 and the common partner TIR3. Scientists at Monell Chemical Senses Center in Philadelphia, PA, discovered that domestic cats and all other felines have a mutation in the TIR2 gene which produces a dysfunctional sweet receptor. So felines cannot taste sweet and do not perceive it as a pleasurable stimulus. Cats do however, have a strong sense of taste for umami since those receptors are not mutated.

So why should mushrooms stimulate a receptor which mostly detects proteinaceous compounds? Understanding this requires a little food chemistry. Proteins are composed of amino acids, the most abundant of which is glutamate. The umami receptor is highly tuned to glutamate although it may respond to some other amino acids. But the response to glutamate is much stronger if the stimulus also contains nucleotides such as guanosine and inosine, which are components of nucleic acids found in all living tissues. You will note that many foods in the supermarket contain added disodium guanylate and disodium inosinate as flavor components because they enhance the flavor of umami, which is a preferred flavor for all people.

Mushrooms have high levels of nucleotides as well as reasonably high levels of glutamate and therefore have a strong umami flavor. Hence both humans and cats like mushrooms. Fish also contain high levels of glutamate and nucleotides and are used widely in cat foods. Other foods rich in glutamate and nucleotides include cheese (especially aged hard cheeses such as Parmesan and Romano), tomatoes (esp. sun-dried ones), and nori (Japanese seaweed).

Note also that cantaloupe and green beans, also preferred by Ellen Jacobson’s cat, contain high levels of glutamate.

AMERICAN MATSUTAKE

Elizabeth Schneider

Food Arts, July/August 2000,

via *Mycolog*, Humboldt Bay Myco. Soc., October 2001

The American matsutake, white matsutake, or pine mushroom (*Tricholoma magnivelare*), primarily from the Pacific Northwest, is a relative of the Japanese matsutake—a seasonal prize second only to Alba and Perigord truffles as luxury items. Impressive mushrooms, large, heavy, and pale, they may weigh in at ½ lb each.

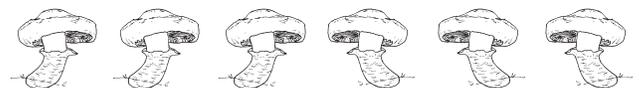
Aroma: Authorities extol the magic of matsutake’s powerful spicy aroma, which I have never discovered, although I have enjoyed the mushroom. Perhaps I am too far from the forest? Unlucky? Impervious? The ones I have cooked are more memorable for texture—comparable to firm, fiberless white asparagus. The aroma has been subtle and fleeting, pine-tinged and peppery, with a touch of mint; the flavor sweet and balanced. Turning to others for description, I discover that either matsutake or responses vary considerably. Elizabeth Andoh, Tokyo-based authority on Japanese food and culture, finds a “deep, woody, green fragrance.” Higgins loves “the amazing cinnamon-musk pheromonal pungency.” Anne Gingrass (chef/co-owner, Hawthorne Lane, San Francisco) tastes a “rounded, elegant, and soft flavor, with citrus and sherry notes.” Lincoff describes “the special cedary scent.”

Use: “They are so expensive, and such concentrated flavor bombs,” says Higgins, “that we use them as the principal in a dish. It’s not a mushroom meant for Western ingredients, particularly dairy. Rice, dashi, and fermented soy products are what it needs—or to be grilled dry.” Roast, steam, or cook en papillote or in stock. To sauté is taboo.



Selection: Choose rock-hard mushrooms, as aromatic as possible, from fall to winter. Squeeze the stem to check “give”—which means insects lurk—or split mushrooms to check. Grades and prices are based on shape. The astronomically priced closed-cap No. 1 is desirable for its lack of insect infestation. The least pricey No. 6 may be opened out, browning, and broken but may taste fine. Choose according to use and budget. “Pricing is driven by Asia. If their season is poor, U.S. prices are out of sight,” says Higgins. “If they’re available, then all grades are usually to be had.”

Preparation: Clean matsutake need only be rubbed with a damp towel. Some require trimming, peeling, brushing, and rinsing, which does not harm the solid interior. While clean to the eye, embedded grittiness is common. It’s prudent to peel stems, which may be fibrous; save trimmings for stock. The mushrooms do not discolor when cut and remain white for hours. Break into irregular pieces or slice. For grilling, cut apart stem and cap; flick gills clean with brush. Trim and peel stems, then halve lengthwise.



FUNGAL BIOPESTICIDE SET TO FREE SHEEP FROM LICE

<http://media-newswire.com>

October 8, 2009

In research that could have international significance, scientists in Queensland, Australia, may have developed a way to control sheep lice using a naturally occurring fungus called *Metarhizium* isolated from Queensland soil.

“Trials conducted by a QPIF Senior Scientist Diana Leemon have shown the fungus caused a significant reduction in lice numbers on sheep,” said Tim Mulherin, Minister for Primary Industries and Fisheries, Queensland (QPIF).

Mulherin congratulated Leemon and her team and said the research using fungus to treat sheep lice could have major ramifications throughout the world. “There are no treatments of this type currently available, and there is an urgent need for environmentally friendly lice control,” he said. “Producers are reporting sheep lice are becoming a major problem, particularly following a recent ban on the use of the effective insecticide diazinon in a wet dip.

“Parasites such as sheep lice damage wool and reduce yields, leading to significant losses for the producer.”

“Lice cost the Australian wool industry \$123 million annually through lost production and control costs.”

Leemon said considerable research was required to select the best strain of fungus and to develop a suitable method for application to sheep.

“We also investigated how the fungus kills lice,” she said. “When the fungal spores are applied to the sheep, they stick to the surface of lice as they move around in the fleece. The lice also consume spores as they feed on wool grease, and the spores germinate inside the insect, killing it.

“We’re hopeful the techniques involving the application of fungal spores to control parasites on sheep could also be used in other livestock industries.”

QPIF and Australian Wool Innovation Limited (AWI) have signed an agreement with a commercial partner, Becker Underwood Australia, to conduct field trials required for the fungal biopesticide to be registered with the Australian Pesticides and Veterinary Medicines Authority.

“The findings could put Australia on the world stage in terms of its research, and also boost our wool and sheep industry,” AWI CEO Brenda McGahan said.

PRESIDENT’S MESSAGE

Patrice Benson

I just came from a membership meeting at which at least 200 folks attended to watch a fabulous presentation by Taylor Lockwood and sign up for our annual wild mushroom exhibit! It was fantastic to see so many diverse, enthusiastic members. Many people signed up to help with everything for the weekend’s big exhibit and fund raiser. I am so impressed with the awesome generosity of our members! Many thanks to all who helped with all of the minutia of putting the show together and then taking it apart after the public was awed and educated about Pacific Northwest fungi.

I would especially like to thank Kim Traverse for stepping up to the leadership role of show chair. Our mushroom exhibit is one of the biggest in the country and is a great opportunity for our

members to learn about fungi and to get to know other mushroom enthusiasts.

We are honored to have two more mycologists in our midst at this time. I wish to welcome Tuula Niskanen and Kare Liimatainen and their daughter (not yet a mycologist), Aava, to Seattle and to our organization. You will be meeting them soon!

I would now like to welcome all of the new members who joined our group at the exhibit this year. We hope to keep you in awe of the fungi and their potential for happiness in your lives. Hunting, eating, and admiring the forms, colors, and scents are just the beginning. There are crafts to explore such as dyeing and felting wool as well as photography and cooking. Cultivation of fungi is fascinating and educational for our children. The hiking and exploring the mountains and forests are one of life’s greatest pleasures for the mushroom hunter.

At the November meeting, we are anticipating a wonderful lecture by Dr. Tom Volk of the University of Wisconsin. Dr. Volk is a wealth of information about fungi. Be sure to check out his wonderful website at http://botit.botany.wisc.edu/toms_fungi/.

Tom will be speaking at the Meany Lodge joint foray with the Mountaineers on Halloween weekend as well as at the PSMS meeting November 10. Do NOT miss this talk about “Spores Illustrated.” It will be delightfully informative and entertaining!

Please sign up to attend the Nisei Veterans special field trip at the Dalles campground on highway 410 outside of Enumclaw past Greenwater, Washington, on November 7. It should be a wonderful experience and a truly historic event.

Again, thank you to all who helped at the 46th annual Wild Mushroom Exhibit. We need and cherish each and every one of you.

AUSTRALIAN PERIGORD TRUFFLES CAUSE A STIR

theage.com.au, June 12, 2009

They’re just a fungus, but West Australian truffles are causing a global gastronomic fuss.

The state’s truffle harvest is under way in the southwest, where The Wine and Truffle Company is reaping the benefits of a big gamble in an unlikely location.

Managing director Wally Edwards said Western Australia is now producing up to 80 percent of Australia’s truffles. “It’s hard to determine because not many people tell anyone else what they’re doing or producing, but anecdotally we have to say most (Australian truffles) seem to be coming out of Manjimup” in the state’s southwest, Edwards said.

It all began in the late 1990s with a group of friends whose children played cricket together. “It started off as a bit of a hobby really,” Edwards said. “We really didn’t go in with great expectations to be honest. It was a group of friends that believed in Nick Malajczuk and his vision and his science...and he was so passionate and so sure he could grow truffles. We didn’t even know what truffles were, but we followed him and he’s delivered.”

The company expects to harvest up to a ton or more of truffles [*Tuber melanosporum*] this season. Truffles fetch as much as \$3,000 a kilogram.

Western Australian truffle



ROAST CHICKEN WITH MATSUTAKE STUFFING

Western Montana Mycological Association
<http://www.fungaljungal.org/recipe/matsie.html>

1 3½ pound chicken
1 TBs butter
1 cup dry white wine
3 TBs extra virgin olive oil
1 small onion, minced
¼ pound fresh matsutake, chopped
¼ cup toasted pine nuts
1 cup fresh bread crumbs
1 egg
1 tsp ground nutmeg
Salt and pepper to taste



Serves 4.

Preheat oven to 375°F. Place olive oil in a skillet over medium heat and sauté the onion until softened, 2–3 minutes. Add the mushrooms and continue sautéing until mushrooms are cooked through, 4–5 minutes (you might have to add some water to the pan). Remove from heat and stir in pine nuts, bread crumbs, egg, nutmeg, and salt and pepper.

Stuff and truss chicken, place breast side down in a roasting pan, and add ¼ cup white wine. Roast 45 minutes, turn chicken over, dot with butter, and roast 45 minutes more or until a meat thermometer reads 185°F. Transfer to a platter and keep warm. Add remaining wine to roasting pan, boil over high heat, scraping up any brown bits and reducing liquid by half. Add salt and pepper to taste. Carve the chicken into 4 servings and serve with stuffing, wine sauce, and seasonal vegetable.

Cooking Tips: First, matsutake doesn't like butter or other mushrooms! Butter's too sweet and creamy and clashes with the heady fragrance of the mushroom. Because of this quality, other mushrooms are totally eclipsed, but if you have only a few mat-

sutake and you need more for a recipe, I suggest using the small store-bought button mushrooms, as they will absorb the matsutake flavor and have a similar texture.

Second, matsutake absorbs whatever medium you are cooking it in, as opposed to most mushrooms which exude their own liquid. So keep a close eye on them when cooking or you'll have smoldering black chunks in your frying pan!

As a result, matsutake tastes best when cooked in olive oil (the fruity flavor really works with the pine thing) or a light broth (chicken or vegetable). If pairing with meats, grains, or vegetables, choose mildly aromatic accompaniments, such as chicken, plain pasta/risotto or potatoes, or tofu (eggs may mask the flavor somewhat).

UNIVERSITY OF BRISTOL MANIPULATES GENOME OF ANTIBIOTIC-PRODUCING FUNGUS

<http://media-newswire.com>, Oct. 15, 2009

Researchers at the University of Bristol, led by Professor Gary Foster and Dr Andy Bailey, have been able to manipulate the genome of the fungus *Clitopilus passeckerianus*, which produces a natural antibiotic called pleuromutilin. Foster's team was able to switch off individual genes and to target native and foreign promoter regions into the *C. passeckerianus* genome to stimulate the production of fluorescent proteins which could be seen under the microscope.

"The ability to transform and manipulate the host organisms that produce these new antibiotics, such as derivatives of pleuromutilin from *Clitopilus*, will be a vital tool for discovery and development of new antibiotic products," said Foster.

Clitopilus passeckerianus



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

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