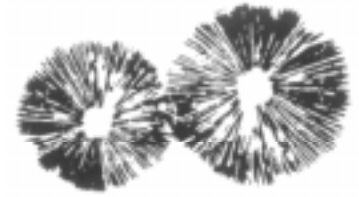


SPORE PRINTS



BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY
Number 413 June 2005

PRESIDENT'S MESSAGE

Ron Post

Summer is approaching, and your presence is welcome at the **annual picnic, Saturday, July 30**, at Seward Park from noon until 5 PM. It will be informal this year, with no reservation at the park. However, any number of people can have a lot of fun. Look for the PSMS signs in Seward Park that Saturday. Bring something to share, and we'll have an hibachi or two in case we cannot grab a picnic space with a grill.

One of our newer members, a budding watercolorist whose mushroom art has attracted some attention, has agreed to give **our annual exhibit** poster a shot. More on this later!

The Christmas Party and Survivor's Banquet may have been the social events of the year for some, but the May field trips at **Eagle Creek**, hosted by Brian Luther and Coleman Leuthy, were right up there in popularity. As a token of our appreciation, the club presented two aspen tree saplings to Brian and Coleman. May the aspen trees grow and clone themselves into a beautiful forest with lots of fungi.

About 40 volunteer hours were put in relabeling and cataloging **our library collection** this spring, and the board voted in May to hire a UW graduate student to put the collection on database. When it's done, a list of holdings from that database will be posted on our Web site and updated periodically.

By the way, our collection of **exhibit posters**, sitting in the library, would also look great on the new Web site, wouldn't it? If you have the time and expertise (and camera) to photograph a couple dozen of them and e-mail them to our Web designer, please contact me and we'll get to work!

In case you have wanted **access to our microscopes**, all of the binocular scopes are now cleaned and in decent repair. All of them now have illuminators. The monocular scopes have not been maintained as well but were not in as bad shape as those that have had more (in some cases, less) use. Most of the monocular ones have illuminators, too. So, you can check one out from the library if you have taken one of the PSMS microscopy classes. If not, you are still welcome to come and get to know them at CUH (under supervision) this summer. Just contact me at (206) 527-2996. We'll set one day a month, or more if there's enough interest.

My heartfelt thanks to Patrice Benson and Brian Luther along with all the other volunteers and class leaders for making the **George Rafanelli Memorial Foray** at Cispus a real success. One of our newest members, cartoonist Dave Poling, designed the "*Boletus rafanellii*" art for the front of the memorial T-shirt.

I encourage anyone interested to attend the NAMA foray in LaCrosse, Wis., this July. You can access the NAMA Web site at www.namyco.org.

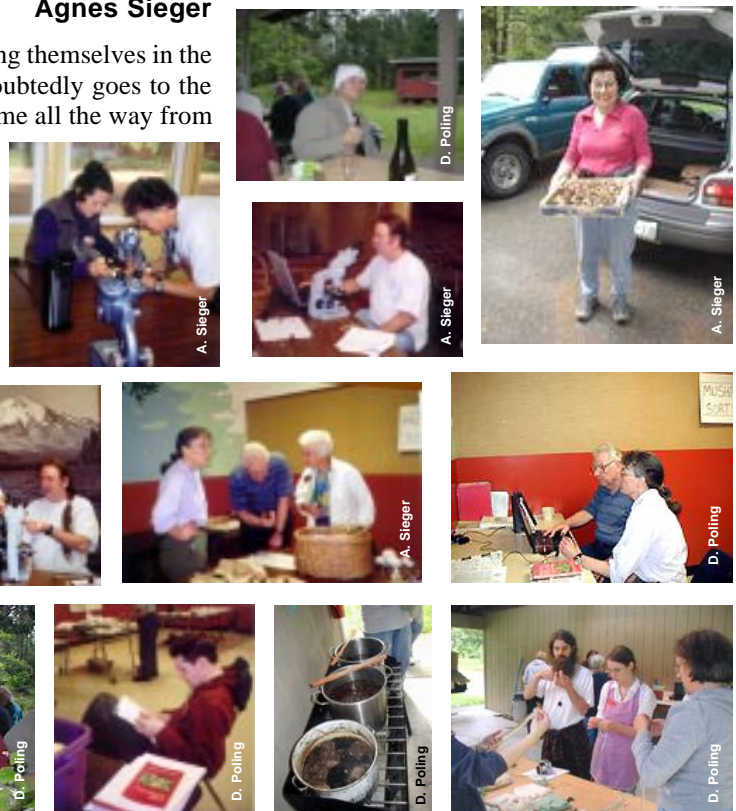
GEORGE RAFANELLI MEMORIAL FORAY, 2005

Agnes Sieger

They came, they saw, they learned their mushrooms, while enjoying themselves in the process. The prize for the people coming the most distance undoubtedly goes to the Smiths of Oklahoma. Not only did they drive their new motor home all the way from the Sooner State on the strength of the write-up on the PSMS Web site, but they had never been on a mushroom foray.

Neophytes and veterans alike picked Judy Roger's brain all day in the microscope class, while artistic types gathered in the covered pavilion to drown yarn in various dyes made from fungi. Throughout it all, puzzled but hopeful identifiers thumbed through *Mushrooms Demystified* and other keys trying to stick a name on their finds with hints from PSMS ID Chair Brian Luther, who enthusiastically shared his wealth of knowledge of things mycological.

Afterwards, because mankind does not thrive on work alone, miscellaneous forayers gathered here and there to toast the day, nosh on goodies, and reflect on mushrooms and other topics before wandering off to bed.



Spore Prints

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CALENDAR

June 14 Membership Meeting, 7:30 PM, CUH
June 20 Board Meeting, 7:30 PM, CUH
July 11 Board Meeting, 7:30 PM, CUH
July 30 Annual Picnic, 12–5 PM, Seward Park
Aug. 15 Board Meeting, 7:30 PM, CUH
Aug. 23 *Spore Prints* Deadline
Sep. 13 Membership Meeting, 7:30 PM, CUH

BUSHII, CHENEYII, AND RUMSFELDII

New York (Reuters), 14 April 2005 - Two former Cornell University entomologists have named three species of slime-mold beetles in the genus *Agathidium* after U.S. leaders, Cornell announced on Wednesday—to wit, *A. bushii*, *A. cheneyii*, and *A. rumsfeldii* for President Bush, Vice President Dick Cheney, and Secretary of Defense Donald Rumsfeld.



MEMBERSHIP MEETING

Tuesday, June 14, at the Center for Urban Horticulture, 3501 NE 41st Street, Seattle

As of press time, no program has been announced for the June meeting. Come prepared to be surprised and astonished.

Note that this will be the last meeting of the spring season. The next membership meeting will be September 13.

Will people with last names beginning with the letters M–Z please bring a dish or refreshments to share at the meeting.

EAGLE CREEK FIELD TRIP

Ross & Val Othus

PSMSers all, this past weekend (May 7–8) we had a gathering and hunt to match the best of our events for several years. Our hosts, Coleman Leuthy and Brian Luther, shared their properties off Eagle Creek Road near Leavenworth as our gathering and camping place.

Saturday morning fifty-three of us listened as Brian briefed us on the local fire “hot spots” and the “do’s and don’ts” for safe hunting, and encouraged the sharing of especially good spots with us all. And, as usual, several of us more seasoned veterans led groups to the areas. Gathering was good to very good, and at day’s end we all met to share stories and prizes. Larry Baxter and Brian even found several ‘shrooms discolored from fire retardant while checking the higher elevations. Nearly everyone had treasures to display.

We shared two potlucks under the star-filled sky. We had tents, trailers, and campers. There is a lot of space. Coleman and Brian, Kathy and Don Lennebacker, and Doug U’reen were great hosts. Larry Baxter and Brian did the identification.

For those of you who may have missed this spectacular and wonderful event, there will be one more—this time on Memorial Day weekend. The morels should be plentiful and awaiting each of us. If you have never done a weekend mushroom hunt, I recommend this as one you will value and remember.



CIRCLE 8 FIELD TRIP, APRIL 30

Lynne Elwell

Circle 8 is such a nice place to have a field trip, very welcoming to ‘shroomers. The kitchen-eating area now has a nice new porch protected by a windbreak of Lucite (or similar product).

About 35 eager, hopeful morel hunters arrived, munched muffins, and fortified themselves with coffee. They then scattered all over Circle 8 property and parts unknown to try their luck and test their hunting skills. It was either feast or famine for morels. Several people filled baskets or daypacks, but many others found almost nothing except verpas, which were everywhere. When I went out I grew to resent the verpas, which look so much like morels until I get close. Other than verpas and morels there were very few mushrooms to be found, but Josh Birkebak cheerfully identified the meager find.

No one stayed for potluck, so my daughter and my dogs and I had the beautiful campground to ourselves for a quiet evening, quiet that is except for hundreds of frogs. My thought for the evening was how lucky I am to belong to PSMS.

MUSHROOM OF THE MONTH

Dick Sieger

Blewits survive. They survive week after week untouched by vermin. Following a hard frost they will shrug off the ice and survive. Young ones replace old ones and they survive.

And I let them survive. Others relish their flavor but for Agnes and me they are indifferent fare.

It may be the way they are cooked, although I follow Larry Stickney's imperative to prepare them with dairy products.

Lepista nuda (aka *Tricholoma nudum*), the Blewit, may be found any time of the year growing in the forest duff near an old horse manure pile behind our house. They are big chunky mushrooms and often grow so close to one another that taller ones leave pale pink spore prints on their companions. The color of the young fresh mushrooms—cap, gills, flesh, and stalk—is a lovely violet. All parts of the mushroom become brown or buff in time. When evaporation dries them, thinner parts of the cap fade so the margin becomes pale and the center remains dark. The caps can be 1½ to 6 inches across and sometimes much larger. The stalk is half as long as the cap is wide so the mushrooms are squat. Blewits smell nice.

Some robust mushrooms that are poisonous, *Cortinarius* species and others of that ilk, may have the violet color of fresh Blewits but will leave brown spore prints. A couple of other *Lepista* species may, at times, look like Blewits but neither is poisonous. After they turn brown, Blewits may be difficult to identify, so, as always, use a good field guide or the *MatchMaker* program for confirmation.



BOG BLOG 7 – *Russula crassotunicata*

Christie Robertson

When you think of mushrooms that are present year-round, you probably think of perennial conks, like *Fomitopsis pinicola* and *Ganoderma applanatum*. But in the bog, we've got a gilled mushroom that's around all year, even if it's not always in the most appetizing state—*Russula crassotunicata*.

Like some kind of myco-zombie, this beast turns brown, rots, molds, and stinks to high heaven over a period of months. But it just never seems to go away. This persistence may be a key reason that this mushroom is an important host for some of our other fascinating



Russula crassotunicata
in the spring

bog mushrooms, but that is the topic of another Bog Blog, soon to be coming your way!

Russulas are notoriously difficult to tell apart from one another, but *R. crassotunicata* is one *Russula* that we are lucky to be able to identify every time. While it took us all a while to become comfortable with interpreting the test for *R. crassotunicata*, we all perform it now with confidence. The test goes like this:

1. Grab. Grab a piece of the “pellicle” (skin) of the cap at the margin where it meets the gills. If it's *R. crassotunicata*, this might actually be a bit difficult, since the pellicle of this mushroom is very gelatinous or leathery (depending on age and weather).
2. Peel. Once you get a grip, all you have to do is gently pull back toward the center of the cap.

If your mushroom is *R. crassotunicata*, the pellicle will peel well back toward the center in a strip. Do this sometime when there are other *Russulas* around, so that you can compare the feel. There is some basic-level keying information on this and other *Russulas* in the Pacific Northwest Key Council key to *Russulas*, <http://www.svims.ca/council/Russul.htm>, and in David Arora's *Mushrooms Demystified*.

Russula crassotunicata is aptly named. According to *Mushrooms*



Demystified, “crass” means “fat,” “thick,” “big,” or “heavy” and “tunic” means “garment.” It's the *Russula* with fat clothes.

Russula crassotunicata
in the fall

PSMS SUMMER PICNIC, JULY 30

Where: Seward Park

When: Saturday, July 30, 2005, 12–5 PM

Directions: Go to the west side of Mercer Island and swim across the lake or, from Seattle, take I-5 to I-90, get off at exit 3 (west side of Lake Washington), go south on Rainier Ave. S. about 3 miles, and take a left onto S. Orcas Street, heading east. South Orcas Street ends at Seward Park after intersecting Lake Washington Blvd. S. Once in the park, follow the PSMS signs up the hill to the picnic spot.

Food: Please bring a potluck salad, side dish, or dessert to share. Bring your own meat to barbecue, buns, sauces, eating and serving utensils, and sunscreen (hopefully). Drinks, plates, cups, charcoal, and lighter will be provided by PSMS.

Facilities: Shelter, tables, grills, tennis courts, kids' playground, rest rooms.

Activities: Bring any games you'd like to share such as badminton or croquet sets. There are also trails through or around Seward Park, swimming, Frisbee catching, kite flying, boating (a public boat ramp is nearby), bicycling, and mushroom hunting (in July?).



PROPOSED STATE PARK COLLECTING REGULATIONS

John Goldman

Initially, I reported that, as Kelli Burke told us at the May meeting, the State Parks' Commissioners were going to discuss mushroom collecting at their meeting on June 9 in Colville. However, that has been delayed until the meeting on August 4 on Whidbey Island, so you have two months to write them and tell them how you feel about the proposed regulations. The commissioners are a group of volunteers, and Kelli told me that they don't have a collective e-mail address, so your choices are snail mail or to show up at the August 4 meeting, which is open to the public. To learn more about the Agency, go to <http://www.parks.wa.gov/agency.asp> and if you want more info about the meetings, click on the left side of that page on "commission meetings."

Here is the address to convey your feelings about the proposed 2-gallon limit described below.

Washington State Parks and Recreation Commission
C/O Commissioners
P.O. Box 42650
Olympia, WA 98504-2669

WAC 352-28-030 Harvest of edibles. *Non-marine edible plants and edible fruiting bodies, including mushrooms, shall be managed by the agency in accordance with WAC 352-28-010. The commercial harvest of edibles is not allowed on park lands. The harvest of edibles for personal consumption, or scientific or educational projects, is subject to the following conditions:*

(1) *Personal consumption: The recreational harvest, possession, or transport of edible plants and edible fruiting bodies including, but not limited to, mushrooms, berries, and nuts, is allowed up to an amount of two gallons per person per day, unless otherwise posted at the park. The harvest amount may be comprised of one or more species. The harvest may occur within the following park classification areas: recreation, resource recreation, natural, natural forest, heritage, or in parks not yet classified. No harvest of edible plants or edible fruiting bodies, including mushrooms, is allowed within a natural area preserve.*

(2) *Scientific or educational projects: The harvest of edible plants and/or edible fruiting bodies, including mushrooms, for scientific or educational projects is subject to the prior written approval of the director or designee. The approval shall specify a harvest amount not to exceed the minimum quantity necessary for the purposes of the project. The harvest may occur within all park classification areas.*

(3) *Harvest techniques that involve raking or other techniques that have the potential to degrade park natural or cultural resources are prohibited.*

(4) *The director or designee may close, temporarily close, or condition public access to certain park areas for recreational harvesting of edibles upon finding that the activity degrades or threatens to degrade the park's natural or cultural resources, or to protect public health, safety, and welfare. Such closure shall be posted at the entrance to the park area affected and at the park office.*

Kelli said that if you have any questions, feel free to contact her: Kelli Burke, Environmental Specialist, Washington State Parks and Recreation, (360) 956-4804, kelli.burke@parks.wa.gov. However, your feelings will be counted only if you snail mail the commissioners or attend the meeting.

MORE ON THE DEADLY JAPANESE SUGHIRATAKE STUDY *The Mycophile*, NAMA May/June 2005



You may recall reading about some recent deaths in Japan following a rare "brain fever" of kidney patients after the consumption of wild mushrooms. The deaths were a mystery, as the cause—a kind of oyster mushroom known locally as *sughiratake*, or "Angel

Wings"—has long been consumed there as a safe edible species.

A recent report in the Japanese newspaper *Yomiuri Shimbun* may provide clues that lift the veil on this mystery. Tomihisa Ota, a scientist specializing in natural products chemistry at the School of Natural Sciences and Technology of Kanazawa University, has found that when mice are injected with an extract of the sughiratake mushroom, they suffer a toxic reaction that causes kidney failure. Not exactly the effect you want your wild mushrooms to have on your body!

The research team led by Professor Ota obtained the extract by heating sughiratake gathered last autumn in Tohoku and Hokuriku Prefectures (Japan) to 90°C for 30 minutes. The team injected mice with one milligram of extract per gram of body weight. Seven of the ten mice injected died within 24 hours. The mice are suspected to have died of shock caused by damage to red blood cells and kidney failure. The toxic effects were not seen in extracts heated to boiling (100°C).

Interestingly, the mushroom is often prepared by boiling in miso soup, which may provide a detoxifying effect. According to Prof. Ota, a toxic sugar protein that is not destroyed by heating the mushroom to the temperature of miso soup was suspected of being contained in the mushrooms or in organisms attached to them. It is possible that the toxic substance enters the bloodstream, destroys red blood cells, and produces a toxic effect, Ota said.

The sughiratake mushroom is probably better known in North America by its scientific name, *Pleurocybella porrigens*.

SUMMARY OF MUSHROOM POISONINGS IN 2004 Michael W. Beug, Chair, NAMA Toxicology Committee

In 2004 members of the Toxicology Committee reviewed and often investigated reports of 148 humans poisoned, including 40 children and adolescents. We also received reports of 51 dogs stricken by eating mushrooms. For the first time in several years there were four reports of human deaths—three confirmed and one possible—from mushrooms. We feel that this was due to the fact that the mushroom season in the western half of the United States was exceptional, with record fruitings of many species. In addition, the hurricanes that affected the Southeast brought lots of rain during mushroom season there. With a record abundance of mushrooms and an increased interest in the harvest of edible wild mushrooms, there was an associated increase in the number of poisonings.

The overwhelming majority of reports received over the past year have again come via the work of Marilyn Shaw, of Denver, CO. Most of her reports result from her close cooperation with the Rocky Mountain Poison and Drug Center (RMP& DC). She also talks frequently with people involved in the poisonings in order



to identify the mushrooms as accurately as possible, to obtain detailed information on symptoms experienced, and to try to determine what led to the ingestion.

Hanna Tschekunov reported calls to the Florida Poison Information Center Network. Judy Roger investigated mushroom poisoning reports from the Oregon Health Sciences University, Oregon veterinarians, and the Oregon Mycological Society Website. Judy regularly went to the site of the poisoning to collect mushrooms and often was able to do microscopy from the vomitus of the victims to positively confirm most of her identifications.

Raymond Archambault provided information about poisonings in the Quebec area. Additional reports were received as a result of concerned individuals locating the NAMA Web site or contacting the author through his mushroom Web site (www.evergreen.edu/mushrooms).

All confirmed deaths of humans were from eating members of the “Destroying Angel” group of *Amanita*. One death reported from Minnesota was due to ingesting *Amanita bisporigera*, one from Quebec to eating *Amanita virosa*, and one from California to consuming *Amanita phalloides*. These mushrooms contain amatoxins. There may also have been a death due to kidney failure of a man in California collecting “Boletes.” Eight dogs died or were euthanized after mushroom consumption. In the dog fatalities *Inocybe* species were confirmed in about half of the cases and *Amanita* species in the other half.

It is important to note that at least eleven or twelve Asian immigrants mistakenly consumed either *Amanita phalloides* or *Amanita bisporigera* (cases in Oregon, California, and Minnesota). Several other poisonings also involved recent immigrants from various parts of the world where mushroom collecting is practiced. There is clearly a need to find a way to educate recent immigrants about dangerous lookalikes to mushrooms that they are familiar with from their home country.

In one incident seven Korean immigrants stated that they thought they had consumed a *Volvariella*. In many Asian countries, the choice “paddy straw mushrooms” (*Volvariella* spp.) are abundant. These pink-spored mushrooms look very similar to the white-spored “Destroying Angels,” especially when they are young and the pink spores are not yet in evidence. In addition to a difference in spore color, the *Volvariella* species lack a partial veil.

In the past Italian immigrants have consumed *Amanita phalloides*, mistaking it for the choice edible “Coccora,” another *Amanita* with a distinct cup-like volva. While usually *Amanita phalloides* is greenish and “Coccora” is yellowish, both can be rather white at times. One person who likes to eat *Amanita vaginata* got *Amanita phalloides* instead.

This past year, at least 22 people mistook *Amanita pantherina* and *Amanita muscaria* for an amazingly wide range of edible mushrooms. Two couples, one in Washington and one in Montana, ate young *Amanita muscaria* thinking they were eating puffballs. Remember—edible puffballs are pure white inside and soft like a marshmallow.

Four people mistook *Amanita muscaria* for Matsutake, and two people ate *Amanita pantherina* thinking that it was Matsutake. If they had used their noses to seek out the delightful cinnamon spice/dirty-sock smell of Matsutake and their sense of touch to squeeze the uncrushably dense flesh of Matsutake, they would not have gone wrong.

A group of six thought that they were eating “Shaggy Manes”! One person thought that she had “After-the-Rain Mushrooms.” In many cases we have no idea what the victims thought they

were eating. What the 27 dogs thought they were eating is anyone’s guess.

As usual, *Chlorophyllum molybdites* claimed a significant number of unwary victims. Indeed, I suspect that many of the fifteen “unknown” poisonings reported from Florida were due to ingestion of *Chlorophyllum molybdites*. Since this lawn mushroom is common in warm humid areas, and since it is big and meaty with a good flavor and closely resembles the “Shaggy Parasol,” it frequently gets the attention both of young children and of adults who should know better. The symptoms are always severe gastrointestinal distress. However, the onset is sometimes delayed as long as six hours, causing real panic in Poison Centers since delayed onset of symptoms is characteristically associated with the deadly mushrooms.

In the fall of 2004 at least thirteen deaths were reported in Japan, all associated with the consumption of *Pleurocybella porrigens*, “Angel’s Wing.” All the individuals who died (of an acute brain condition) had kidney disorders. Since Angel’s Wing is common in the United States, it is important to alert mushroom pickers to its potential danger to people on dialysis, though whether it was the mushrooms themselves or some contaminant in Japan remains to be researched.

Meanwhile, I have no record of this species ever causing a poisoning in North America. I have eaten it occasionally and have once or twice served it to my mycology students over the years, but it is not that great tasting. Just to be safe, it is now off my list.

In a number of cases, the poisoning involved a popular edible species. Most of these cases are examples of individual food sensitivities. However, as in years past, five people became ill after eating morels—some in association with alcohol, but some where no alcohol was involved and the mushrooms were thoroughly cooked.

In some of these cases “False Morels,” which I presume to be either *Verpa bohemica* or *Gyromitra esculenta*, are suspected. There is actually a significant commercial market for *Verpa bohemica*, and many people relish eating it! Others react strongly to *Verpa* spp. and/or to *Morchella* spp.

There were also two reports of poisonings from consumption of the choice edible *Cantharellus formosus*, and reports of one human and one dog from *Tricholoma nudum*. Members of the *Armillaria mellea* complex growing on conifers also caused several poisonings. *Boletus edulis* caused gastrointestinal distress in one couple. *Leccinum manzanitae* caused one case of GI distress in California, and an unidentified *Leccinum* was implicated in a severe case of stomach cramps in Oregon.

Lentinula edodes purchased from a store resulted in a severe poisoning and coma for one person. Two people had adverse reactions to consumption of *Leucoagaricus leucothites*, a mushroom that I don’t recommend eating in any case because it looks so much like a “Destroying Angel” if someone cuts the stem off and misses the buried volva of the *Amanita*. A man from Wisconsin reported a case of severe contact dermatitis (poison ivy-like rash) from consuming *Laetiporus sulphureus*. That brave soul confirmed his suspicions by eating a small amount of the “Sulfur Shelf” a second time and suffering a milder repeat of the symptoms.

The committee also saw a much larger than usual number of reports (16) of ingestion of hallucinogenic mushrooms where the individual suffered a bad trip and wound up in the hospital. One person reported adverse effects that persisted for

cont. on p. 6

2004 Poisonings, cont. from p. 5

purchased “hallucinogenic” mushrooms but got taken by consuming some “raw shredded brown mushrooms” that produced vomiting and diarrhea along with tachycardia and a big hospital bill but no hallucinations. While most of the intestinal ingestions of hallucinogenic mushrooms involved teenagers and young adults, there were also reports of people from their 40s through 60s trying the magic mushrooms.

Of the over 50 dogs made ill by mushrooms, either or *Amanita pantherina* was implicated in over half of the cases. In one case a dog was euthanized when it went into the coma typical of this kind of ingestion. We suspect that had the vet waited, the dog probably would have recovered, unless it was otherwise in very poor health. At least eight dogs consumed *Inocybe* species. Judy Roger confirmed by study of the vomitus that *Inocybe geophylla* or *Inocybe lilacina* was involved in two of three lethal cases. At least three dogs died from suspected mushroom ingestions where no expert had the chance to determine the mushroom involved.

If you hear of mushroom poisonings in the future, you are encouraged to go to the NAMA Website (www.namyc.org) and file a report. These reports will help us to better understand what mushrooms should be avoided and what to expect from a specific mushroom ingestion.

Also, lest this report leave you too depressed, remember that mushrooms in general are far less toxic than plants. Unlike plants, no mushroom is so poisonous that you cannot handle it safely. Of the thousands of species of mushrooms out there, only a handful are deadly. All that is needed is a little better education. Most people would never dream of randomly eating any wild plant they might find (or for that matter any bulb that they might dig up in their flowerbed), but for some reason, once they get the nerve to try wild mushrooms, people often proceed with inadequate information. Help us change that situation.



FUNGAL WEED KILLER GOES TO MARKET

Tim Hoskins

Farm and Ranch Guide, 14 April 2005
via *The Sporeprint*, L.A. Myco. Soc., May 2005

A fungus that can kill broadleaf plants, including Canada Thistle, dandelions, and chickweed, is working its way to the marketplace.

Karen Bailey, a plant pathologist with Agriculture and AgriFood Canada, works to identify micro-organisms that can be used for pest control. As part of the job, she surveys and tests sick weeds to find out what is making them sick. In her tests, Bailey noticed one organism—a fungus called *Phoma macrostoma*—would show up consistently from different provinces across the country in dead weeds that were sent to her. “It is an opportunistic fungus,” Bailey said. The fungus lives off soil debris and then invades a plant through a wound caused by another pathogen.

In 1998, she realized there was potential for *Phoma macrostoma* to control weeds. Since then she has conducted more research on the fungus. When it is applied directly on a leaf, it produces a scab or two but does not hurt the plant. However, when it is applied to the soil, it inhibits the ability of many broadleaf plants to produce chlorophyll, and the young plants turn white and die.

“The fungus exists in nature at low levels,” she notes. However, Bailey has looked at increasing its levels to develop weed control. In addition, she has watched to determine its effect on the environment.

First, researchers looked at different hosts to see how they might be controlled by the fungus. It affected Canada Thistle, dandelions, chickweed, and a number of other broadleaf weeds. However, it did not affect grass weeds, such as foxtail.

Next, Bailey tested how the fungus affected crops. She found it would not damage cereal and grass crops. However, broadleaf crops such as canola and lentils were damaged by the fungus. “I expect no problems with corn,” she said. “With soybeans, I am afraid it won’t work well.”

The fungus is applied in a granular form directly to the soil, Bailey says, and controls weeds for about one month from the time it is applied. In looking at some of the environmental effects of applying higher levels of the fungus to the soil, she found that the levels seemed to drop quickly. “It does not survive well,” she noted.

Four months after application, fungus numbers in the soil drop significantly. One year after application, the fungus can’t be detected. To check for any lingering effects of the fungus, Bailey treated an area and then one year later planted peas, which are susceptible to the fungus, at the same location. The peas were fine. “We know there is no carryover” (from one year to another).

Bailey said that an industry partner, The Scotts Co., will bring the product to the marketplace. The first commercial application of using the fungus likely will be in the lawn and turf grass area. Agriculture will be the second application. Another application would be tree nurseries.

Some research needs to be done about how to switch from lawn and turf applications to using it on row crops. The formulas and economics for agricultural applications will need to be worked out, she noted.

Bailey said it could be 2–8 years before the fungus will be available. However, she adds researchers are closer to working with government regulators to develop guidelines to ensure product safety.



Canada Thistle plants turn white and eventually die as the amount of *Phoma macrostoma* applied to the soil increases and inhibits the plant’s ability to manufacture chlorophyll. Photo courtesy South Dakota State University.

WHEN MUSHROOMS GO WILD

Independent News & Media (UK) Ltd.
via *The Sporeprint*, Los Angeles Myco. Soc., Feb. 2005

The apparently sedentary life of forest-floor fungi is not what it seems, says Simon Hadlington. There are countless battles raging underfoot.

A quiet stroll in the woods can be the perfect antidote to a noisy, fume-filled, jostling urban jungle. But while on the surface everything may appear calm and tranquil, beneath the feet, in the rotting leaves and in the dead branches, silent battles are being fought with a terrible ferocity. This is the dark, mysterious, and surprisingly violent world of fungi. These organisms spend their lives searching for new sources of food, and when two fungi come across the same piece of dead wood or pile of leaves, a battle for supremacy can ensue.



(from *Le Gratin des Champignons*,
Sabatier & Becker)

At Cardiff University, Professor Lynne Boddy has been studying fungus wars for more than 20 years. Boddy's motivation is to try to develop a fuller understanding of these interactions, of the role fungi play in the wider ecosystem of the woodland, and of the 3.9 billion hectares of the Earth that is covered by forest. "After all," she says of her work, "before we can save the planet we need to know how it works."

Fungi are supreme waste recyclers. They release nutrients locked up in dead tissues and make them available again. Because of this, the ecology of the fungus is crucial to the wider ecology and health of the woodland.

Professor Boddy has set up conflicts between different species of fungus and watched as one defeated the other. "We have arranged fights between scores of different fungi and have a sort of league table," Boddy says. "Some are much better fighters than others. But just because one fungus is top of the table it doesn't mean it's going to win every time. Just like sports teams, some fungi have their bogey opponents who they simply can't beat."

When we think of a fungus we usually envisage a mushroom or toadstool, or occasionally a bracket fungus clinging to the side of a tree. But these external manifestations are merely the fruiting bodies—the structures that produce the spores. The main body of the fungus consists of fine, filamentous "hyphae," the mass of which is called the mycelium. Sometimes many hyphae will intertwine to form visible string-like mycelial cords. The mycelium grows out across the forest floor in search of new resources.

When one part of the mycelium discovers a new source of food, it can send a chemical message to the rest of the network to dispatch resources to that point, so that enzymes can be manufactured to digest a newly found cache of dead wood or fallen leaves.

"During their growth and search for new resources, fungi will inevitably meet one another," says Professor Boddy. It is here that combat can occur. But the interaction between the mycelia of two fungi is more complicated than a simple competition for food. "We prefer the term 'combat' to 'competition,'" she continues, "because one fungus can attack another in a very aggressive way, not just to secure an item of nutrition but to defend an entire territory. Once the fungus has marked out its territory it can then consume the resources within it at its own leisure."

A number of different scenarios may unfold when two fungal mycelia meet. If the two fungi are of the same species, they might mate. If they have already mated, then they often reach a kind of compromise, and a stand-off ensues, with neither advancing into the other's territory.

If fungi of different species meet—and in British woods there are hundreds of different species—battle commences with one eventually gaining the upper hand and advancing into the opponent's territory. Sometimes there will be stalemate if both are equally adept fighters.

"If you take a dead branch from a tree or from the forest floor and cut a section through it, you will see elaborate patterns of black or even orange lines," says Professor Boddy. "These mark the boundaries between the territories of individual fungi growing in the wood—they are the battlefronts where the mycelia have been slogging it out."

To understand precisely how fungi fight one another, the Cardiff researchers have been carrying out a series of experiments in the laboratory where trays of soil or dishes of agar are inoculated with different fungi and their interactions are observed. As the fungi grow, their mycelia advance toward each other until they meet.

"One scenario is like hand-to-hand combat," Professor Boddy says. "A hypha of one fungus coils around a hypha of its opponent and actually penetrates it, almost literally sucking the life out of it." This phenomenon is termed mycoparasitism.

Other battles resemble chemical warfare. "Here, when the hyphae or mycelial cords meet there is a release of chemicals," says Professor Boddy. "We don't know the identity of most of these, but there is a lot of interest among chemicals companies, as these substances could possibly be supplied as "natural" fungicide. It is clear that some very exotic chemicals are produced in response to a fight. Some of these are spectacularly pigmented."

There appear to be two main strategies for chemical warfare between fungi. "Sometimes you see very close interaction between opposing hyphae and, presumably, there is some subtle release of chemicals that results in one or other retreating, or else deadlock," Professor Boddy says. "On the other hand you can get a massive release of hugely powerful enzymes that obliterate the opponent very quickly. All the hyphae in that region are destroyed."

Intriguingly, volatile chemicals are sometimes released by the fighting hyphae which attract insects. "What we don't know is whether it is somehow in the fungus's interest to attract these insects, or whether it is merely coincidence," Professor Boddy says. "For example, insects called springtails are attracted to certain fighting fungi, and burrow into the zone where the mycelia are interacting. We are looking into this to see if there is any advantage to either of the combatants or the insects."

The Cardiff team has shown that different parts of the mycelial network are capable of communicating with one another, and that during fighting there is active communication throughout the organism.

"We set a fungus to fight with an opponent and then inoculated it with a labeled phosphorus compound, which we can trace," Professor Boddy says. "When the mycelium met its opponent we saw that phosphorus from all over the mycelium was mobilized and rapidly transported to the battlefront. The organism was devoting large internal resources to the fight. However, when it appeared that it was losing the battle, it rapidly shunted its resources as far away as possible, presumably so that the enemy did not capture them."

cont. on page 8

Fungal Wars, cont. from page 7

Working with Dr. Jonathan Leake of the University of Sheffield, the Cardiff team has also looked at the fighting strategies of a class of fungi that form associations, called mycorrhizae, with plants. These fungi live in intimate contact with the roots of plants, providing the plant with nutrients and water from the soil and receiving sugars in return.

“What we have seen here is that when a mycorrhizal fungus meets an enemy in the soil, the allocation of carbon to the interaction zone rapidly reduces,” Professor Boddy says. “We presume that this is so that the resource is not gambled with. It isn’t clear whether it is the plant, which supplies the carbon, that is controlling this decision or whether it is the fungus.

Even when a fungus is not involved in a fight, the mycelium is constantly responding to external stimuli. “We have seen, for example, that if one part of the mycelium encounters a new resource, it will colonize it and send a message to the other regions of the mycelium to send supplies to enable it.”

MOREL BREAD PUDDING

Patrice Benson

6–7 cups of cubed crusty bread
3 cups of milk, cream, or half and half (soy milk as last resort)
1½ cups grated cheese (Swiss or similar)
¼ cup Parmesan cheese
6 eggs
Herbs of choice, 2 TBs or so; celery is also nice in this
1 lb or more sautéed morels or mushrooms of choice
1 onion or 2–3 shallots, chopped fine or big
2–3 TBs butter or olive oil
Salt and pepper to taste

Sauté mushrooms in butter or oil, add onions, cook for about 5 minutes or until limp.

Place bread cubes in the bottom of a buttered or sprayed baking pan 9 × 13 in.

Layer on the cheese and mushrooms and sprinkle with herbs. Mix milk or cream with eggs and add ½ teaspoon salt and ¼ teaspoon pepper or as to your taste. Pour liquid over bread and mushrooms. This may be covered with plastic wrap and stored in the fridge overnight or bake right away at 350°F for about 50 minutes or until puffed and browned slightly. Let cool slightly and serve.

200TH ANNIVERSARY ISSUE

While typing in the *Spore Prints* number, I realized that this will be my 200th issue as editor of the PSMS newsletter. At ten issues a year, that’s ... gulp, 20 years worth.

Twenty years ago, we hand typed everything on an old IBM “Executive” typewriter (the letters came in different sizes, from two spaces for “t” to four or five for “M,” so correcting a typo was murder) and made screened prints of all the graphics on a giant copy camera at my office (ahh, 10 PM Sunday night in the dark-room struggling for the right exposure). The type and graphics were then hand-pasted onto an oversized copyboard, hand carried to the printer, and reduced 20% (those rubber cement fumes might explain a lot). Now everything is done on computer in Word and PageMaker. The articles come already typed or are OCR’d (scanned into an optical character reader), and the graphics are inserted and sized electronically. The touch of a button speeds the copy to the printer.



— Agnes Sieger

*That’s all until September.
Have a good summer!*

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