SPORE PRINTS

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Holiday Cookie Bash, 2006

Spore Prints

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PUGET SOUND MYCOLOGICAL SOCIETY

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Annual dues $25; full-time students $15

CALENDAR

Jan. 9	Membership Meeting, 7:30 PM, CUH
Jan. 15	Board Meeting, 7:30 PM, CUH
Jan. 23	*Spore Prints* deadline
Jan. 31	Lichen Class, 444 Hitchcock Hall, UW
Feb. 4	Lichen Class Field Trip
Feb. 7	Lichen Class, 444 Hitchcock Hall, UW

2007 LICHEN CLASS

Dennis Oliver

Dr. Glew

PSMS is pleased to announce that Dr. Katie Glew will be again offering a five-session lichen class (with the fifth session on the crustose lichens) this winter. The class will begin on Wednesday, January 31, and run for the next four Wednesdays at Hitchcock Hall (room 444) on the University of Washington campus. A field trip is planned for February 4, 2007, to collect specimens for class and to view lichens in their natural habitat. The class costs $45.00 and is limited to PSMS members. Space constraints limit enrollment to 18 people. If interested please e-mail education@ psms.org (preferably) or leave a phone message at (206) 722–0691 if you do not have e-mail.

Dr. Katie Glew received her Ph.D. in Botany from the University of Washington specializing in alpine lichens and their ecology. She also directs the Seattle Lichen Guild. The suggested book for the class is McCune and Geiser's *Macrolichens of the Pacific Northwest*. This book, as well as other mushroom books, will be available for sale at the monthly PSMS membership meeting.

MEMBERSHIP MEETING

Tuesday, January 9, 2007, at 7:30 PM at the Center for Urban Horticulture, 3501 NE 41st Street, Seattle

Our speaker for January is Daniel Winkler, and his topic will be "The Mushrooming Fungi Markets in Tibet."

Dan Winkler

For centuries, Tibetans have collected and traded mushrooms. Improved communication and the commoditization of natural resources have caused an astounding mushrooming of the fungus industry. The market is dominated by the caterpillar fungus "yartsa gunbu" (*Cordyceps sinensis*), matsutake (*Tricholoma matsutake*), and morels (*Morchella* spp.). An array of other mushrooms—such as *Amanita*, *Armillaria*, *Auricularia*, *Boletus*, *Cantharellus*, *Ganoderma*, *Hericium*, *Lactarius*, *Leccinum*, *Paxillus*, *Ramaria*, *Rozites*, *Sarcodon*, and *Suillus*—is also economically important.

Yartsa gunbu (*Cordyceps sinensis*) alone accounts for over 95% of the fungi market in Tibet. Currently it is the world's most precious fungus at over $30,000/kg retail. In Tibet, it contributes 40% to the rural cash income. Its contribution to the Gross Domestic Product equals the whole secondary industry (manufacturing and mining). Every year in spring, Tibetans move up to the grasslands to collect this elusive tiny medicinal fungus feeding on the larva of the ghost moth. Since 1998, I have been tracking yartsa gunbu—researching fungi markets, collection areas, and its importance for Tibetan people.

Daniel Winkler, trained as a geographer and ecologist, works as researcher and consultant on environmental issues of the Tibetan Plateau and Himalayas. He has published on forest ecology, traditional land-use practices, and medicinal plants and fungi. His articles and photo essays are published on his website (www.danielwinkler.com). He lives in Kirkland, Washington, and has been a member of the Puget Sound Mycological Society since 1996.

Would persons with last names beginning with the letters A–L please bring refreshments for the social hour?

MINNESOTA MUSHROOM POISONING

Britt Bunyard, *The Mycophile*,
North American Mushroom Association, Nov./Dec. 2006

A tragic case of mushroom poisoning occurred this fall in Minnesota. The state Health Department there reports that seven members of a Hmong community in the Twin Cities were hospitalized September 9 after eating poisonous mushrooms they picked in St. Paul's Keller-Phalen Regional Park. A 10-year-old girl died on September 15; two others were still hospitalized in intensive care as this issue went to press. All the other members of the family were recovering. Minnesota Mycological Society experts Ron Spinosa and Anna Gerenday were called to the hospital to identify a specimen that was brought in with the patients. The mushrooms were confirmed to be the Eastern American Destroying Angel *(Amanita bisporigera)*, which can easily be mistaken for non-poisonous mushrooms, especially the paddy straw mushroom, *Volvariella volvacea*, popular in Southeast Asian cuisine. Anna recently told me that this case has kept her very busy, and she recently gave a presentation at a poison control center to help educate the public on identification of poisonous mushrooms.

NEW CASTLE FIELD TRIP — Russ Kurtz

October 28, 2006, was a bright sunny day, perfect for a field trip. New Castle State Park is small with a nice beach and a large lawn area surrounded by cottonwoods and some birches. The park has a big shelter with several large tables and benches. As usual, coffee, tea, and cookies were available all day.

Sixteen people signed in. Many were new members, some with children who were most eager to go mushrooming (and were very good at finding the elusive fungi). Since the park is so small, the area had been pretty well covered within an hour, so I recommended that those who wanted go either to Cougar or Tiger Mountain to see what they could find. Mushrooms were identified from 9 AM to 3 PM. Twenty-one fungi were found:

Armillaria mellea
Boletus chrysenteron
Boletus scabrum
Boletus zelleri
Cantharellus cibarius
Clavaria vermicularis
Clitocybe dilatata
Coltricia cinnamomea
Coprinus lagopus
Cortinarius sp.
Fomes pinicola
Hygrophoropsis aurantiacum
Lactarius sp.?
Lepiota rhacodes
Lycoperdon pyriforme
Mycena sp.
Naematoloma capnoides
Naematoloma fasciculare
Pleurotus porrigens
Pluteus cervinus
Russula brevipes

I think a good time was had by all. Better hunting next year!!

THE INTERNET OF THE FOREST — Terry Taylor

Mycofile, Vancouver Myco. Soc., Nov. 2006

Just as the human community has its Internet, so also does the forest community have its Internet, and this Internet is created and maintained by the fungi. Fungi are the recyclers. They are also the destroyers, as well as the sustainers of forest life. Without fungi there could be no forest, there would be no trees.

Let us first consider the recyclers. Without the recyclers dead leaves, branches and tree trunks would gradually build up on the forest floor. If not for the recyclers these materials could not decay, and their constituents would not become available for succeeding generations of organisms. Decomposition is caused by fungi and bacteria, and in forest habitats most of it is due to fungi.

If you look at rotten wood you will see there are two kinds—white and brown. White is cellulose, and brown is lignin. Cellulose is made of sugar-long chains of glucose molecules. It is the main component of wood fibers. Lignin is the glue cementing the fibers together. It is a complex compound which strongly resists decomposition. The elimination of lignin is the principal reason why pulp mills use so many caustic chemicals. Before wood fibers can be made into paper they must be separated from the lignin.

The familiar red-brown stumps so common in local coniferous woodlands are almost entirely composed of lignin. The story of how they came to be, is a fascinating one, a story of recycling, reuse, and regeneration. Several species of fungi create these rotten stumps. The most common one is the Red Belt (*Fomitopsis pinicola*). These are the familiar bracket or ear-like structures often seen on tree trunks. They are hard and woody and colored white below and brown above, usually with a reddish-brown outer zone. This bracket, however, is not the organism itself, but is the reproductive organ of the organism—like a flower on a plant. The white underside has many tiny holes, and inside these holes microscopic spores are produced. The spores float away on air currents and occasionally one of them lands on some exposed wood or log and germinates.

It is inside this wood where the action is taking place. Microscopic filaments of the fungus itself grow through the wood, producing enzymes which digest it. Unlike animals fungi digest their food outside their bodies, and then ingest the by-products of that digestion. In the case of brown-rot fungi those by-products are glucose. Cellulose is made of glucose, and these fungi have the ability to extract that sugar and use it to build their own bodies, including the big brackets. That sugar was originally made in the needles of the tree's canopy by taking carbon dioxide from the air and water from the soil and combining them using the energy of sunlight. After the cellulose is decomposed, and made into fungus tissue and not tree tissue, the brown stuff—lignin—is left behind, eventually crumbling and entering the soil.

But what are the white rots? Rotten wood that is white is being attacked by fungi which consume both cellulose and lignin. When lignin is removed the cellulose fibers still remaining are no longer cemented together, and now form soft stringy masses, very similar to the pulp produced in pulp mills. Many of the pollutants from these mills are chemicals used to dissolve the lignin holding wood fibers together. White rot is essentially a natural pulping operation! Conversely, some pollutants are similar enough to lignin that white-rot fungi will degrade them.

Wood decaying fungi may be the recyclers of the forest, but they are slow recyclers. Trees make wood to last a long time, sometimes a very long time. If we look at an old growth forest from the point of view of nutrient cycling, the complete cycle for a very large, very old tree can be over 2000 years. Not only can an ancient forest not be duplicated for many human lifetimes, but the processes involved in such forests are older than the ages of the oldest trees within the forest. The largest trees in the coastal forest are Douglas fir and western redcedar. In some cases both these species can attain ages greater than 1000 years. When large trees such as these blow down it takes a long time for the logs to decay, especially the cedar, which contains large amounts of decay-resistant chemicals. About 500 years is probably required to return the log to the soil. However, it is mostly the cellulose which has been removed by this process. Much of the lignin still remains. Look at the ground in a conifer forest and you will see it tends be a rusty brown. This is the color of small lignin particles that have not yet broken down. It may take another five centuries to completely remove this lignin.

Fungi, however, are not just recyclers. Some of them are also required to initiate the cycle. To see how they do this we need to look at the mushrooms. Every autumn mushrooms cover the forest floor—many different forms, shapes, and shades. But mushrooms are not fungi themselves, rather they are flowers of fungi. Microscopic spores are produced on the gills, the plates beneath the cap. These act as invisible seeds that float away on air currents. On an October day the air is filled with billions of them—an unseen aerial ecosystem. Many of these mushrooms are produced by decay fungi, but most of the large ones are from mycorrhizal fungi. Mycorrhiza means fungus root. These are fungi which grow in a mutually beneficial relationship with the roots of plants. Not all plants live in a close association with fungi, but most of them do.

All our trees have their fungal helpers, and this is how they help. Tree roots spread outwards through the surface layers of the soil, gathering water and dissolved minerals, but the roots spread a

cont. on page 4

Forest Internet, *cont. from page 3*

relatively short distance from the trunk. Attached to the roots are the thin microscopic threads of the fungal partners. They radiate out much farther from the tree than the roots themselves do, and they also gather water and dissolved nutrients. These they transport back to the root tissues, from whence they are conveyed into the tree's branches and leaves. Not only do the fungal threads extend farther out than the roots do, but since they are so thin they can fill the interstices between the roots, essentially increasing the roots' surface area many fold. In return the fungi use about 10 percent of the tree's glucose production to build their bodies and power their metabolism. Fungi send water and minerals to build the leaves and wood of a tree's canopy, and the leaves of the canopy send sugar into the ground to build fungi and their mushrooms.

The comparison of fungal networks to the Internet is especially true for the mycorrhizal webs, for the threads of these fungi can be attached to the roots of several different trees. A single individual can be attached not only to more than one tree at a time, but also to some herbaceous plants. Some of them even parasitize and consume small insects in the soil and deliver the nutrients contained in them to the tree roots. When the autumn rains arrive you can see evidence of this fungal Internet for yourself. Many of the mushrooms on the forest floor, especially the big ones, are the reproductive structures of mycorrhizal fungi. They function as fungal flowers, producing millions of microscopic spores, which drift through the forest, mingling with the spores of many other fungi—an invisible ecosystem of aerial plankton.

There is also a third fungal lifestyle, and this is the lifestyle of the parasite. These are the fungi that grow on living plants. Most of them are very small or even microscopic, but their effects can be devastating.

Parasites are the controllers of the forest. Some of them are insects such as the mountain pine beetle and spruce budworm, but a significant number are fungi. Especially significant are parasites introduced from one part of the world to another part, for the new host species may have no resistance to the invader. Parasites to a great extent determine the composition of the forest environment. The plants which are successful in any forest are those which have learned to co-exist with their parasites.

A micro-fungus that has had a major impact on our west coast forest is the white pine blister rust (*Cronartium ribicola*). This rust originally came from pines in eastern Asia, but spread to Europe when its host tree was introduced there. In 1910 some infected pines where transported to Vancouver from France. The infection was then spread by wind to an alternate host plant, one of our native currants or gooseberries, and from there to the western white pine (*Pinus montieoa*). White pine was once a common tree in local forests, but now is only occasionally encountered. It is even possible that western white pines may become extinct. Introduced microfungi have had a similar profound effect on chestnut and elm trees in eastern North America.

Not all parasitic fungi are microscopic. Most of the large shelf fungi on living trees are produced by parasites. However, like many other things in nature, the relationship is not that straightforward. The heartwood inside a tree is no longer alive. If the fungus is living on dead wood inside a live tree is it a parasite or a wood decayer? Some parasites even kill their hosts to live on the dead tissues.

One of the most infamous and fascinating of parasitic fungi is the *Armillaria* root rot (*Armillaria ostoyae*), which produces large clusters of mushrooms, called honey mushrooms, on woody substrates. This species is able to subsist on either live or dead wood of many different trees, and has a significant impact on forests. For this reason it has been studied extensively, but before the advent of DNA fingerprinting it was not possible to ascertain the genetic differences between one honey mushroom and another honey mushroom. When new molecular techniques became available they showed that the *Armillaria* root rot over large areas of forest was genetically identical. In other words it is the same individual—in some cases occupying areas greater than 1000 acres! Some researchers believe these are the largest organisms in the world. This could not be discovered until fairly recently, as one honey mushroom looks essentially the same as another honey mushroom. Once the fungus infects a tree it can spread by means of root-like structures from that tree to other trees or stumps, and it can do this for century after century, holding its territory against other individuals of the same fungus. Even most forest fires cannot change this, for the *Armillaria* survives in the dead roots of the previous forest, and re-infects the succeeding forest. The honey mushroom truly illustrates the pervasive control parasites can have over their hosts.

This invisible fungal web permeates the forest. Hidden within its food supply it does not become apparent until fruiting structures, in all their multifarious shapes and colors, are produced. It is the recycler when trees have lived their lifespans. It is the sustainer of these trees while they are growing, and finally it is the destroyer of those same trees.

THE PRODUCTION OF INK FROM THE SPORES OF FUNGI

Rolf Singer

Priroda [*Nature*], No. 1, January 1938, pp. 121–123,
translated from Russian by Elena Sivan-Loukianova,
transcribed by Dean Abel,
via *Symbiosis*, newsletter of the Prairie State Mushroom Club

Many mushrooms produce spores with dark pigments that may be used for producing ink for calligraphy and printing. Species so employed are found in the genera *Lycoperdon*, *Bovista*, *Pisolithus*, *Polysaccum*, and *Scleroderma* among the Gasteromycetes and also species of the Ustilaginea [rusts], Elaphomycetales [truffles], and even Myxomycetes [slime molds]. But until now no experiments have been carried out to study the serviceability and usefulness of such inks.

More than 100 years ago the French mycologist Buillard [Jean Baptiste Francois Bulliard, 1752–1793] recommended the dung loving species of *Coprinus* [Inky Caps] for producing ink. Herein is reported the satisfactory results obtained using inks prepared from *Coprinus atramentarius* [the Alcohol Inky Cap] and *Coprinus comatus* [the Shaggy Mane or Lawyer's Wig] which are common fungi found in gardens and other rich places.

In the Soviet Union many mushrooms with a cap possess interesting possibilities. *Coprinus* species have gills which are very close together and the edges of which are not perpendicular to the stem even upon maturity, and because of that the spores do not fall downward to be spread by the wind. Instead the gills deliquesce or dissolve and become smeared upon passing animals which spread the spores.

C. atramentarius and *C. comatus* are the largest inky cap species common in Europe and Asia. As an edible mushroom *C. comatus* is good, but it does not make as black an ink as *C. atramentarius*. Thus this report will limit discussion to the latter.

C. atramentarius has a cap that is gray brown, furry, and with central flakes or scales upon the surface. The cap is striate and shaped like an egg or a bell 5–10 cm in diameter. The gills are at first white, then brown, and finally black and melted together. The entire cap becomes an inky liquid. The spores are ellipsoid 7.5–11 × 4.5–6.5 microns; the stem is white and hollow; the inferior ring or annulus about the stem soon disappears. The trama or flesh of the mushroom is white to gray brown and without odor. It fruits in dense clusters from May to November. [This description is an abridgement of the technical diagnosis in the original].

With regard to making ink it is important to collect the mushroom before it is fully deliquescent and thus too old. On the other hand, if the harvested material is not developed enough, then the quality of the ink will be bad. One must filter the fungal liquid through thick mesh cheesecloth and then decant and discard the top clear layer of liquid above the dark residue of the spores. This separates the unpigmented material from the spores.

The inky deposit is quite gritty and therefore one should add gum arabic to promote adhesion. [Historically, gum arabic—a water soluble gum obtained from several species of the acacia tree—was used to increase the viscosity of ink, or to make it flow well, to prevent it from feathering, and to suspend the coloring matter]. The native ink has two features: (1) it has an unpleasant smell, and (2) it tends to separate and form a hard precipitate. Therefore, in addition to gum arabic, a perfume such as clove oil is incorporated which also helps preserve the ink. Before using a pen with a nib, shake the ink in the bottle.

Spore ink produces a pleasant black-brown color similar to Chinese inks. The ink may be saved for as long as 8 years. As a natural science exercise, students could prepare ink for themselves for use in school.

Herbarium slides of spore prints are very stable, and the spore ink is permanent. The shape of the spores in the ink is constant, and it is easy to look at the paper with a microscope to confirm that a signature on an important document agrees with the original ink. Oxalic acid from sorrel does not destroy or bleach the pigment of the spores, and therefore spore ink ensures protection against forgeries employing detergents or acids to erase the writing. Indeed, inks produced from different mushrooms could be used as "fingerprints" to uniquely identify different writings.

WHITE ROT VS BROWN ROT, AND HOW TO DISTINGUISH THEM

Brian Luther

Many of you may have seen me using a variety of chemical reagents to spot-test fungi on field trips or forays. One that I regularly use on lignicolous (wood-rotting) mushrooms to differentiate between white-rot fungi and brown-rot fungi is guaiac resin, incorrectly called "gum guaiac" in the chemical trade. If a tincture of guaiac resin saturated in ethanol is dropped onto the flesh of a fresh white-rot fungus, the tissue will, with a few exceptions, turn a blue, blue-green, or greenish-blue color. This leads me to a basic discussion of the differences between these two groups of rot fungi.

Wood, which is mostly the dead xylem cells of vascular plants, consists of a dark-colored component called lignin, which is a complex phenolic polymer, and light colored components called cellulose and hemicellulose, which are long chains of polysaccharides. White-rot fungi decompose the dark-colored lignin in the wood along with some cellulose and hemicellulose; thus the decomposed wood is light or "white" in color. Brown-rot fungi, on the other hand, decompose only the cellulose and hemicellulose in wood, leaving the lignin untouched; thus the decomposed wood is dark brown in color. An easy way to remember the difference is that the designated rot type decomposes the opposite colored component of the wood.


Heino Lepp

brown and white rot in wood

Being a white-rot or a brown-rot fungus is such a significant trait that it is used to segregate different genera of wood-inhabiting fungi, even if other characteristics are identical. The vast majority of wood-inhabiting fungi are white-rot fungi. Brown-rot fungi are far less common. Ecologically this is important because both kinds of rot fungi are necessary for a healthy woodland.

The chemical basis for the difference between these two kinds of fungi is that white-rot fungi have evolved to produce polyphenol oxidase enzymes that allow them to break down lignin, whereas brown-rot fungi have not. There are two common phenol oxidase enzymes, namely, laccase and tyrosinase. White-rot fungi may produce one or both of these enzymes and in different concentrations, depending upon the species. We can test for these different enzymes with chemical reagents that react with both or one or the other of these enzymes. Tincture of guaiac resin is a generalist—it reacts with both polyphenol oxidase enzymes, whereas other reagents that I use are specific for one or the other.

Guaiac resin is the natural exudate from the lignum vitae tree, *Guaiacum officinale*, which is native to Central and South America but is established throughout the Caribbean as well. The dried, powdered resin is pale brownish in color and is fragrant, in part, because it contains some natural vanillin. I like the pleasant odor and enjoy working with the stuff.

Guaiac resin is obtained in two ways. One method is to make incisions on living trees and collect the exudate, as is done with many harvestable latexes, tree saps, or gums. Another method is to cut the tree into sections, drill a long hole or several holes in the wood, and then set it on fire. The heat from the fire causes the guaiac resin inside the wood to liquefy and pour out of the drilled holes into collecting receptacles. This is then cooled, dried, and powdered. Guaiac resin is a true resin in that it is soluble only in a solvent and is not a water-soluble hydrocolloid, as true gums are.

cont. on page 6

White vs Brown Rot, *cont. from page 5*

Chemically, guaiac resin is a complex of closely related phenolic compounds. True gums (such as gum arabic or guar gum) are long chains of polysaccharides such as galactose or mannose. Seventy percent of guaiac resin is a-guaiaconic acid, which is the chemical that reacts with the polyphenol oxidase enzymes to produce a blue color.

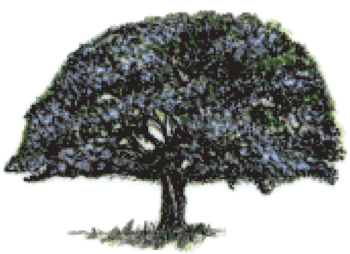
Two early classic works published on this subject are “A rapid test for extracellular oxidase in cultures of wood-inhabiting hymenomycetes” by Mildred Nobles (*Canadian Journal of Botany, 36*: 91–99, 1958) and an outstanding paper by A. Käärik (“The identification of the mycelia of wood-decay fungi by their oxidation reactions with phenolic compounds,” *Studia Forestalia Suecica*, *31*: 1–80, 1965). I could mention many others, so if you’re interested, just ask me sometime.

In addition to guaiac resin, there are many other reagents that can be used to test for white-rot fungi, including a-Naphthol, guaiacol (this is different from guaiac resin), aniline, lacto-phenol, L-Tyrosine, p-Cresol, syringaldazine, and gallic and tannic acids (in culture), to name a few.

Using chemicals or reagents in the field to produce visible color changes always captivates an audience of students, and my goal is to make mycology fun and interesting.

LIGNUM VITAE

Brian Luther



Guaiacum officinale

Often called lignum vitae (translated as “Tree of Life”) *Guaiacum officinale* is a small, evergreen-leaved tree with beautiful blue flowers in the family Zygophyllaceae. In the previous article, I explained about the uses of the resin from this tree in mycology to distinguish white rot from brown rot in lignicolous fungi. Here, I explain a little more about the tree itself and its uses.

Lignum Vitae Wood

Lignum vitae wood is the heaviest, hardest, most dense of all woods. With a specific gravity of 1.37, it is about three times heavier than oak and weighs in at 80–85 lb/cu. ft—so heavy that it sinks in water. On a scale of hardness, oak is rated around 1300, which is a very hard wood, but lignum vitae is rated at 4500, the hardest wood known. Its extreme density—and the fact that it contains a high concentration of resin, which acts as a natural lubricant—makes it especially durable, resistant to fungal decomposition, and almost completely impervious to water.

These characteristics render it suitable for use as mortars and pestles, gavels, bowling balls, croquet mallets and balls, heavy-use mallets, furniture casters, chopping blocks, etc. Before the invention of the higher grades of steel for working or moving parts, it was also widely employed by ship builders for propeller shafts and bearings, high-friction pulleys, rollers, bearings, wheels, and other such tasks.

The wood is hard to work by hand, but it turns well on a lathe. The famous British clock maker John Harrison (who, by the way was the final winner of the longitude problem) used lignum vitae for fine, self-lubricating clock movements.

As with many hardwoods, lignum vitae wood is useful for ornamental carvings and other wooden objects, and there is quite a trade in carved figurines made from this amazing wood. Older objects are quite collectible.

Lignum Vitae Resin

The guaiac resin obtained from the lignum vitae tree has been traditionally used in medicine for hundreds of years for several ailments. It is also used as a food additive and coloring agent and has been shown to have antioxidant properties. Guaiac resin (gum guaiac) is of paramount importance in a critical test to diagnose colon cancer. An infusion of this substance is prepared on fecal test strips, and the subsequent fecal samples are developed in a laboratory by exposing them to hydrogen peroxide and ethanol; if positive for the presence of fecal blood (a sign of colon cancer), the samples turn blue. Simple and effective, this test has saved thousands (maybe millions) of lives.

Guaiac resin is also used to produce a beautiful and colorful stain on the wood used in stringed instruments, in particular violins, violas, cellos, and basses. Several specialty violin makers in North America offer guaiac resin in their catalogs. Guaiac resin mixed with a solvent is rubbed or brushed onto the instrument wood, let dry, and polished or varnished. These violin shops offer guaiac resin (“gum guaiac”) at a significantly lower cost than ordering it through specialty chemical suppliers. I paid only $68 for 100 grams from one violin supplier recently, which is half the price I’ve paid in the past for the same quantity through a chemical supply house, and the quality and effectiveness appear equivalent.

An excellent reference on plant resins is the fairly recent book *Plant Resins: Chemistry, Evolution, Ecology and Ethnobotany* by Jean Langenheim (Timber Press, 2003, 586 pages). However, her brief treatment of guaiac resin makes no mention of its use in mycology as a white-rot indicator, in medicine as a diagnostic test, or as an instrument stain. I wrote to Professor Langenheim giving her this information, and she responded that she was unaware of these other uses and thanked me for the additional information.

HEAVY METALS IN MUSHROOMS

Britt Bunyard

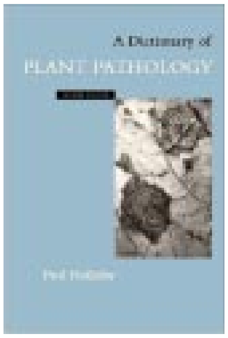
The Mycophile, Nov./Dec. 2006

Be careful what you pick and *where* you pick it. An article by L. Cocchi *et al.* in the latest issue of the journal *Food Chemistry* (*98*[2]: 277–284), entitled “Heavy metals in edible mushrooms in Italy,” warns of eating mushrooms contaminated with toxic compounds. In this study the distribution of arsenic, cadmium, lead, mercury, and selenium was investigated in 1194 samples of 60 species of common, edible mushrooms collected mainly in the province of Reggio Emilia, Italy. The quantitative determination of heavy metals (mg/kg dry weight) was carried out by spectrophotometry, with the exception of mercury, which was determined by atomic absorption spectroscopy.

The amount of arsenic accumulated in the samples studied was generally modest. *Sarcosphaera eximia*, on the other hand, may contain arsenic concentrations reaching 1000 mg/kg dry weight. Within the *Agaricus* subgenus *Flavoagaricus*, only *Agaricus nivescens* contained amounts of cadmium below the allowed maximum level. The cadmium levels in samples of *Amanita caesarea*, *Boletus edulis*, and *Boletus pinophilus* exceeded the maximum amount allowed. (Bad news for Italians—you know how fond they are of porcini!) The content of cadmium in *Agaricus macrosporus* was roughly 50 times the maximum weekly dose recommended by the World Health Organization. The average amount of lead present in all samples was, in general, below the maximum allowed concentration. *Agaricus bitorquis, Agaricus arvensis, Agaricus essettei, Agaricus albertii, B. pinophilus, Clitocybe geotropa,* and *Macrolepiota rachodes* had high contents of mercury, ranging from 5–10 mg/kg dry weight. Mushrooms in general, but species in the *Boletus edulis* group in particular, were rich in selenium.

So it's not simply what you eat, but it's also where you pick it!

BOOK REVIEW — Dick Sieger



A Dictionary of Plant Pathology, 2nd Ed.
Paul Holliday, Ed.
Cambridge University Press, 1992.
Paperback
(ISBN-10: 0521594588 |
ISBN-13: 9780521594585)

A reporter who wouldn't dream about writing about the latest corporate crime without naming the (Wall Street huckster) scoundrel in the first paragraph will write a long article about a plant disease without naming the villain. Agnes likes to include that information in *Spore Prints,* so I help her out by consulting our paperback edition of *A Dictionary of Plant Pathology* by Paul Holliday.

This comprehensive dictionary provides an essential reference for plant pathologists and agriculturalists at all levels, listing the authoritative names of all major plant pathogens and also many minor ones. The pathogens, which include fungi from over 500 genera, 800 viruses, bacteria, mollicutes, nematodes and viriods, are briefly described and supporting references given. Entries are also given for names of diseases and disorders, crops and their pathology, fungicides, taxonomic groups, terminology, toxins, vectors and past plant pathologists. In total, over 11,000 entries provide a wide-ranging resource for all those working in the discipline. The first edition established itself as a "must have" publication for professional plant pathologists. In the 2nd edition over 3000 entries have been added and many existing entries updated and expanded. In addition, common disease names such as "blight" and "canker" are conveniently included under the relevant crop.

Current costs (2006) for the paperback edition (based on prices at Amazon.com) range from $60 (new) to $28 (reprints) to $17 and up (used). Hardback copies are also available for $130.

NOVEMBER BOARD NEWS — Dennis Oliver

The November board meeting dealt with honoraria for speakers at the monthly meeting; now both PSMS members and non-members will receive $100 for speaking. The lichen class (see announcement in this issue) will again be taught this year by Dr. Glew. Field trips for the 2007 season will have a few changes: the host kit will be down sized; we again will be actively seeking hosts for the upcoming field trips; we will limit holding field trips in state parks to two because of the extensive reporting process that the parks require. On gastronomic news, the annual cookie bash has been planned and organized (and as you read this enjoyed!). The survivor banquet will be held on March 10, 2007, and will be a potluck.

UPCOMING EVENTS

2007 Oregon Truffle Festival, January 26–28, 2007. Visit www.oregontrufflefestival.com for details and registration info.

MUSHROOM OF THE MONTH: *Lepiota clypeolaria*

Henk van der Gaag

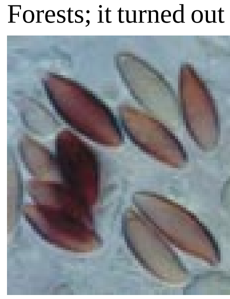
adapted from *Mycelium*, Myco. Soc. of Toronto, Sept. 2003

This month's mushroom is listed in most guide books under the name *Lepiota clypeolaria,* the Shaggy-stalked *Lepiota.* But when the Dutch mycologist Else C. Vellinga moved to California a number of years ago, she was surprised to hear the name *L. clypeolaria* also applied to another *Lepiota* known to her as *L. ventriosospora.* (Remember ventre is French for belly.)

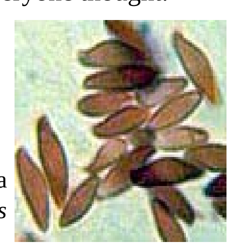
She checked with several herbaria and discovered that there are two Shaggy-stalked *Lepiota* species in North America, as in Europe; but they were lumped together as *L. clypeolaria,* despite the fact that the North American mycologist Murrill in 1912 described a species that was different from *L. clypeolaria.* He named it *L. magnispora.* It turns out to be identical to the European *L. ventriosospora,* and the correct name for that species is now *L. magnispora,* this being the older name.

They are not easy to separate in the field. *L. clypeolaria* is the more subdued colored one, with a pale brown well-defined disc and fine yellowish brown scales or fibers on a pale background on the rest of the cap. The stem is covered with white woolly cottony fibers. *L. magnispora* is supposed to be stronger colored. The ones I have seen look different, with a less defined disc and a stem with a more yellowish covering. (Have a look at *L. clypeolaria* in the Audubon guide—that is a typical *L. magnispora!*) The only sure way, unfortunately, to distinguish them is by the spores. In both cases they are long, 11–16 µm for *L. clypeolaria* and up to 20 µm for *L. magnispora.* But it is the shape that counts. *L. magnispora* spores have a straight "back" and a "belly" plus a depression under the apiculus (the site where the spore was attached to the basidium). Vellinga aptly dubbed them penguins. *L. clypeolaria* spores have a curved back and no clear depression at the apiculus.

There is of course little known about the distribution of these two species. Vellinga thinks that here in the east *L. clypeolaria* is the more prevalent one. When I checked old species lists, our own and those of other groups, of course only *L. clypeolaria* was mentioned. Except, and get this, on a list of a Parkin foray on September 1990 at Kingston Farms; there it was a *L. ventriosospora*! So our own late guru Jack Parkin was ahead of everybody. Last fall I already started looking for shaggy-stalked ones, and I promptly found some at Pefferlaw and Durham County Forests; it turned out they were *L. magnispora,* so maybe they are not so rare here as everyone thought.



L. clypeolaria *spores*



L. magnispora *spores*

There was an old woman
in her mushroom home...

ROASTED SHIITAKE SOUP

Mycelium, Vol. 26, # 3, Myco. Soc. Toronto
via *NJMAnews*, New Jersey Myco. Assn., Jan.–Feb., 2001

1 pound shiitake mushrooms
(or a mixture of shiitake and field mushrooms)
Asian sesame oil
Salt and white pepper
2 TBS olive oil
1 small onion or 3 to 4 large shallots, chopped
3 garlic cloves, minced
4 to 6 cups chicken or vegetable stock
Fresh chervil sprigs for garnish
White truffle oil (optional)

In shallow pan, toss trimmed mushrooms with a little sesame oil; season with salt and white pepper. Roast in a 375ºF oven 20 to 25 minutes or until tender and slightly golden brown. Heat olive oil in a saucepan, add onion and garlic, and sauté until soft, about 5 minutes. Stir in roasted mushrooms and 4 cups stock. Simmer, covered, 30 minutes. Purée mixture in blender or processor, and strain through a coarse sieve. Check seasoning. Thin with additional stock if needed. Garnish with chervil and sprinkle with a few drops of truffle oil, if using. Serves four.

Happy New Year!

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