SPORE PRINTS

BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY
Number 471 April 2011

FOUR NEW SPECIES OF ZOMBIFYING ANT FUNGI FOUND

Danielle Venton

Various sources, March 2011

Four new species of brain-manipulating fungi that turn ants into "zombies" have been discovered in the Brazilian rain forest reports entomologist David Hughes of Pennsylvania State University, co-author of a study published March 3 in *PLoS ONE*. Originally thought to be a single species, called *Ophiocordyceps unilateralis*, all four species are highly specialized on one ant species, *Camponotus rufipes*, *C. balzani*, *C. melanoticus*, or *C. novogranadensis*. The new taxa are named according to their ant host.

These fungi control ant behavior with mind-altering chemicals, then kill them. They're part of a large family of fungi that create chemicals that mess with animal nervous systems.

Once infected by spores, the worker ants, normally dedicated to serving the colony, leave the nest, find a small shrub, and start climbing. The fungi directs all ants to the same kind of leaf: about 25 centimeters above the ground and at a precise angle to the sun (though the favored angle varies among fungi).

Before dying, ants anchor themselves to the leaf, clamping their jaws on the edge or a vein on the underside. The fungi then takes over, turning the ant's body into a spore-producing factory. It lives off the ant carcass, using it as a platform to launch spores, for up to a year.

"This is completely different from what we see in temperate zones where, if an insect dies from a fungal infection, the game's over in a few days," said Hughes. "The fungus rots the body of the insect and releases massive amounts of spores over two or three days. But in the tropics, where humidity and temperature are more stable, the fungus has this strategy for long-term release."

Of the four new species, two grow long, arrow-like spores which eject like missiles from the fungus, seeking to land on a passing ant. The other fungi propel shorter spores, which change shape in mid-air to become like boomerangs and land nearby. If these fail to land on an ant, the spores sprout stalks that can snag ants walking over them. Upon infecting the new ant, the cycle starts again.

The fungi help the forest by keeping ant populations in check. "All of the problems with global ant infestations, for example the Argentine fire ant," Hughes said, "are because the ants have escaped their natural enemies. Then they become a pest."

These fungi need a precise level of humidity to survive. As global temperature changes, the forests where they live are drying. Hughes and his colleagues are now studying the decline of these fungi. "We're worried we'll see the extinction of a species we've only just managed to describe."

D. Hughes

A stalk of the newfound fungus species Ophiocordyceps camponoti-balzani*, grows out of a "zombie" ant's head in a Brazilian rain forest.*

ID CLINIC REPORT

Hildegard Hendrickson

PSMS has achieved a tremendous outreach with our mushroom ID clinics, which are held Mondays during the spring and autumn wild mushroom seasons from 4–7 pm at the Center for Urban Horticulture.

Most Mondays during the fall of 2010, people who brought in wild mushrooms for identification had to stand in line. It helped, of course, that the 2010 fall season may have been the best ever in the Pacific Northwest, and mushrooms in large quantities were found everywhere. Also, word about the ID clinics is getting around, and PSMS members as well as the public are coming in with their collections. Many stay for some time, because the identifiers usually don't stop with the name of the mushroom but also explain the area and habitat. They often just stop short of revealing their own "secret" spots.

Kim Traverse, Danny Miller, and I identified every Monday. Marilyn Droege, Daniel Winkler, and Alyssa Allen dropped in at times, as well as Marian Maxwell, Patrice Benson, and a few of the students from Dr. Ammirati's summer ID class. Many thanks to everyone for their expert service.

About three years ago, past-president Patrice Benson suggested offering the ID clinics, since CUH was open Monday evenings, and the Master Gardeners were holding a clinic there. Many of our new members go out collecting on weekends, and a place and time were needed to help them with ID. It sure did not take long for these ID sessions to become popular. The arctic blast with snow on November 20 abruptly ended the fall mushroom season.

I hope we can say good bye to winter and can welcome a new spring mushroom season soon. Tentatively, the popular mushroom ID clinics held afternoons at CUH in conjunction with the Master Gardeners' clinic will resume Monday, April 18, and continue until the spring season ends.

A reminder: We need all parts of a mushroom for positive identification.

NO MORE POISON CONTROL CENTERS?

Richard Dart

As you may or may not know, the federal funding of poison centers has been cut by the US House of Representatives. I'm President of the American Association of Poison Control Centers and it's taking all our time fighting to get back our funding. If you have the time, please consider going to www.AAPCC.org and click on *Save Our Poison Centers*. It will allow you to easily submit letters to your Representatives and Senators in support of maintaining funding for poison centers.

Spore Prints

is published monthly, September through June by the

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Annual dues **$30**; full-time students **$20**

CALENDAR

Apr. 12	Membership Meeting, 7:30 pm, CUH
Apr. 16	Field Trip (see insert and website)
Apr. 18	Board Meeting, 7:30 pm, CUH Mushroom ID Clinic. 4–7 pm, CUH (tentative)
Apr. 19	*Spore Prints* Deadline
May 7–8	Field Trip (see insert and website)

BOARD NEWS

Marian Maxwell

Election Results: Milton Tam and Denise Banaszewski will continue as PSMS Vice-President and Secretary. Newly elected Board members are Teddy Basladynski, Andrea Rose, Reba Tam, and Linda Haba, and Randy Richardson was re-elected. Our alternates are Debra Lehrberger and Lisa Page Ramey. A big thank you to outgoing trustees Brenda Fong, Jennifer Slack, Kim Traverse, and Debra Lehrberger.

Website: The website is progressing nicely under the care of John Goldman, Jim Hughes, Ann Polin, and Patrice Benson. They are now in the testing phase.

Thanks You: A big thank you to Sara Nelson and Fremont Brewing for donating the beer for the PSMS banquet and to the Dog and Pony Alehouse in Renton for donating pint glasses for the beer! Thanks also to Jerry Mascio and San Gennaro Foods for the donation of polenta and cans of mushrooms as door prizes!

Classes: The new beginner classes are full; intermediate classes have some openings.

MEMBERSHIP MEETING

Tuesday, April 12, 2011, at 7:30 pm at the Center for Urban Horticulture, 3501 NE 41st Street, Seattle.


Marian Maxwell

This month our President, Marian Maxwell, will be speaking on "The Role of Mushrooms in the Ecosystem." She will present what fungi are and how they relate to plants and animals. She will discuss commonly found mushrooms and the roles they play in the environment, knowledge that also helps us in finding and identifying them. She will be assisted in her presentation by Cindy Rogers, a high school student who is studying mycology as her senior project.

Marian studied mycology with Dr. Daniel Stuntz at the University of Washington and has a Bachelor of Science Degree. She has been a PSMS member since 1978. Over the years she has served on the Board of Trustees multiple times and was elected President of PSMS last year. She has been the chair for tray arranging for our annual fall wild mushroom show for over 25 years and frequently speaks at schools, festivals, and clubs in the area, sharing her passion for mycology, PSMS, and its mission "to foster the understanding and appreciation of mycology as a hobby and a science."

MAGIC MUSHROOMS USED MILLENINIA AGO

Toronto Sun, Mar. 23, 2011

Long before the modern hippy discovered them, magic mushrooms—hallucinogenic fungi—were used by ancient humans in religious ceremonies. According to a report in *New Scientist*, a row of 13 small mushroom-like objects in cave paintings discovered in Spain match the known size and shape of so-called magic mushrooms, *Psilocybe hispanica*.

The report notes, however, that these are not the oldest representations of magic mushrooms used by people. A similar mural in Algeria dates the practice as far back as 9000 years.

Board News, *cont.*

Bylaws Revision: The Bylaws Review Committee met before the board meeting and will meet again soon to determine a recommendation to the Board regarding bylaws changes.

Expenditures: A deposit will be made to hold a reservation at Fort Worden for the 2014 NAMA foray. An allotment of up to $1500 was approved for professional accounting advice to help to change over PSMS books from Quicken to QuickBooks to help John with the smooth transition. A decision was also made to split the cost for a Paul Stamets talk on November 12th at the Everett Heritage Museum with Snohomish County Mycological Society. An amount of $1500 was approved for the room and food for the long-term PSMS planning session. Since Brian Luther was notified that he would receive some transportation in the Cypress Island study, the board voted to allow him to spend the PSMS grant monies on needed supplies or equipment.

Outreach: The Board was reminded of PSMS participation in the Rachel Carson Forum at Evergreen College on April 14 and in Mushroom Maynia! at the Burke Museum on May 15.

RESUPINATE FUNGUS OF THE MONTH: The Genus *Phlebiella* © Brian Luther

Species of *Phlebiella* are almost always on the underside of decaying woody debris and are somewhat diverse in outward appearance, varying from waxy to subgelatinous to fibrousy, with a smooth or irregular surface. Some are distinctly fimbriate and rhizomorphic on the margin. Microscopically, species in this genus have rather short pleural basidia (i.e., basidia proliferating basally and laterally from a single basidial cell) and have spores ornamented with very distinct, uniform warts. They appear to be white-rot fungi. I often find species in this genus, and related genera, in a variety of habitats.

Excellent keys, descriptions, illustrations, and discussions of the species in this genus are given by Hjortstam et al. (1988) and Hansen & Knudsen (1997), but I would like to point out that the concept for the genus has changed a bit subsequent to these publications coming out. The genus, as circumscribed now, has only species with ornamented, inamyloid spores. Those species previously in *Phlebiella*, but with smooth inamyloid spores, are now in the genus *Aphanobasidium*; those with smooth amyloid spores are placed in *Amyloxenasma*. Fortunately, we have a major publication that gets us current on the distinctions between these genera (Bernicchia & Gorjón, 2010).

B. Luther

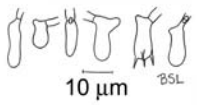
Phlebiella christiansenii
BSL coll. # 2010-617-10

Description of Collection

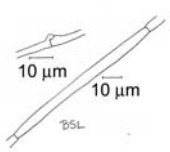
Phlebiella christiansenii (Parmasto) K. H. Larss & Hjortstam.
Brian S. Luther coll. #2010-617-10.
Trail along pond off of West Side Road, above Lime Kiln Point State Park, San Juan Island, San Juan Co., WA. June 17, 2010. On the underside of dead conifer wood on the ground in mixed woods. Associated trees included Douglas Fir (*Pseudotsuga menziesii*), Grand Fir (*Abies grandis*), Red Alder (*Alnus rubra*), Madrone (*Arbutus menziesii*), and Western Red Cedar (*Thuja plicata*).

Basidiocarp: Fully resupinate, radially ridged, creamy yellowish where mature, somewhat shallowly lumpy, soft, cottony, and easily separated from the substrate when fresh, drying fragile and brittle, forming an intricate interwoven, sub aerial layer, hymenial region mostly membranous, but not uniform or continuous over this lower interwoven layer; *margin* creamy-whitish, rhizomorphic, fibrillose, filamentous, and forming a distinct, radial fan-like growth outward. See habitat photo (in color on-line).

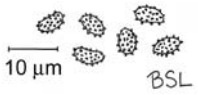
Microstructures: *Hyphal system* monomitic, hyphae 3–5 µm wide, hyaline, thin-walled with occasional clamps and swollen septa. Crystalline material scattered throughout. *Basidia* 18–21 × 5–6.5 µm, short clavate, pleural and with a basal clamp connection, but these can be difficult to view. *Basidiospores* 5–6.5 × 3.5–4 µm (excluding ornamentation), ellipsoid to slightly bean-shaped, hyaline, thin-walled with very distinct, uniform, and evenly spaced tubercula (warts) or echinulations overall, inamyloid. *Cystidia* none. Refer to line drawings.



Basidia



Hyphae with and without clamps.



Basidiospores

Comments

Ginns (1998) says 14 species of *Phlebiella* are known from North America, but several of these are now in the genus *Aphanobasidium* or *Amyloxenasma*, as mentioned earlier. The only species of the genus recorded from Washington State by Ginns & Lefebvre (1993) is *P. sulphurea*, also known as *P. vaga*. It appears that my collection reported on here is the first account of *P. christiansenii* from Washington.

The fan-shaped, rhizomorphic fruiting body is typical for this species of *Phlebiella*. It can be confused with *P. borealis*, which has smaller spores and different hyphae, as well as very mature specimens of *P. sulphurea* (*P. vaga*), which also has smaller spores. But it is unmistakable when young because of its brilliant sulphur yellow color and distinctive red reaction to KOH, which *P. christiansenii* lacks. An additional species of the genus that I often find is *P. tulasnelloidea*, which used to be in the genus *Xenasmatella*. It's a milky white and has a peculiar, thick waxy or gelatinous texture owing to much of the fruiting body being composed of highly gelatinized cells. Another interesting related species that's been reported from British Columbia (Canada) and Idaho is *Aphanobasidium pseudotsugae* (formerly *Phlebiella pseudotsugae*). It has a grayish-white to light ochraceous basidiocarp, occurs on Douglas Fir wood and debris, and has a strong phenolic odor, which is highly unusual. It used to be in *Phlebiella*, but it has smooth spores and now belongs in the genus mentioned above.

In addition to my color photo of this species, Breitenbach & Kranzlin (1986, p. 123) also provide a good photo and description, but under the name *Trechispora christiansenii*.

Based on DNA studies *Phlebiella* was tentatively placed into its own family by Larsson (2007), closely related to both the Polyporaceae and the Corticiaceae. However, it appears that its precise taxonomic position relative to similar fungi is still being determined.

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KUDOS

PSMS Identification and Field Trip Chair **Brian Luther** has been honored with the Washington State Parks Volunteer Service Award for 2010. The award was presented during a ceremony at Millersylvania State Park south of Olympia on March 24.

GOLDEN MUSHROOM AWARD — Marian Maxwell


J. Goldman

This year's recipients of the Golden Mushroom Award are Millie and Irwin Kleinman. Millie and Irwin joined PSMS on January 1, 1985. By that Fall they were already hosting field trips and pitching in to teach newer members about mushroom hunting. Their unstinting contributions to PSMS can be seen from the following list:

1985 Millie & Irwin already hosting field trips and leading mushroom hunts.

1986 Millie served as an alternate on the board and they both continued to serve in hospitality and hosting.

1987 Millie serves as a Board trustee and volunteers as chair for the newsletter mailing committee. Irwin serves as hosting chair and writes up all the field trip reports for the newsletter.

1988 They continue to serve on the mailing committee and as hosting chair.

1989 Millie steps down from the mailing committee.

1990–1992 Irwin serves on the PSMS Board.

1990 Irwin serves on the Nominating Committee.
Irwin volunteers to chair the Feel and Smell Table at the Annual Exhibit. He continues to do this until the present (21 years!!).
Meanwhile they are still hosting, leading hunts, and writing up field trip reports.

1991 They continue to serve on the mailing committee and as Hosting Chair. They volunteer with Coleman Leuthy to coordinate a joint weekend foray with the Mountaineers. They continue to do this every year till 1996 (6 yrs!). They also lead hunts during this foray.

1995 Irwin is working as Hosting Chair, reserving campgrounds, and writing up field trip reports. The May newsletter includes an article on Mary Lynch who thanks Irwin and Millie for "adopting her" and teaching her about mushrooming as they did for so many other people.

1994 Irwin helps teach ID classes for PSMS and does this for many years.

1995 Irwin has heart surgery.

1996 Irwin serves a 2nd time on the Board through 1998. Irwin is on the nominating committee. Millie is serving in hospitality and helping with the annual banquet.

1997 Irwin serves on the nominating committee as well as on a special committee to advise on preparing for the renewal of the CUH lease in 2014 (with Charles Pregaldin, Marsi DiGiovanni, and Russ Kurtz). Again they help co-ordinate the banquet this year.
Irwin gets the roster printed for Pres. Patrice Benson, who did the layout. Irwin purchases a treasury bill with PSMS funds. They both help out at the Lake Quinault Foray in the fall.

1997 Irwin is one of a group of people who earn a Certificate of Achievement from the USDA Forest Service (through David Pilz) for participation in the Chanterelle Study in the Olympic Peninsula. Irwin continues to write up field trip reports for the newsletter.

1998 Irwin is on the Building Fund /Investment Committee.

1999 Irwin volunteers to be the site planner for the field trips.

1999/2002 They continue to participate in field trips, write up field trips, and host.

2003 Millie enters a care facility and dies on May 4. Irwin gives a generous donation to the building fund in honor of Millie.

2003–2011 Irwin continues to chair and serve on the Feel and Smell Table at the Annual Exhibit.

Thank you, Irwin and Millie,
for your MANY Years
of Dedication to
PSMS!

BLUEBERRY RUST: *Pucciniastrum goeppertianum* — Brian Luther

Also called Witches' Broom of Blueberry (Anderson, 1956) and Fir Blueberry Rust, this fungus causes a systemic infection resulting in an unmistakable, perennial, reddish-brown thickening of branches, or Witches Broom.* Here in Washington and British Columbia, it usually occurs on Evergreen Huckleberry (*Vaccinium ovatum*), but it also occurs on several other species of *Vaccinium*, including commercial varieties. It's widespread in some areas of western Washington. If you're out hiking and exploring our woods where Evergreen Huckleberry is common, then there's a good chance you may have noticed it. Refer to the accompanying photo and see if you recognize it.


B. Luther

Pucciniastrum goeppertianum

*Witches Brooms are characterized by large, prominent, abnormal tissue growth and swelling. They occur on many different host plants but usually on trees and shrubs. They can be due to the action of a variety of parasites, including viruses, fungi, insects, and even parasitic flowering plants such as Mistletoe. Aberrant plant tissue growth and swelling caused by insects are called galls individually, but collectively, in mass, they can cause Witches Brooms. From a distance the host plant is obviously distorted, misshapen, or has dense clumps of abnormal growth.

Its range is actually circumboreal across Canada and the US, in Mexico, Europe, Siberia, and Japan (Ziller, 1974), so it's widespread. There are resistant strains that have been developed for commercial Blueberry farms. Don't confuse this rust with Blueberry Leaf Rust, which is a different disease.

What are Rusts?

Have you ever noticed plants that have obvious patches of bright yellow or rusty colored powdery growths on the leaves that don't seem normal? If so, most likely you've encountered one of the stages of a rust. Rusts are all fungi that are pathogenic (disease causing) to plants. They usually (but not always) involve two (or more) separate and unrelated host plants in order to successfully complete their life cycles; sometimes only one host is severely affected, but this is a matter of degree. Often one or both of the hosts have no economic impact, and therefore the effect is not noticed. Sometimes rusts kill their hosts, but often they do not. For the most part, killing the host would mean having to constantly find new hosts, which would result in a survival disadvantage for the parasite. There are over 7000 species of rust fungi. We'll have a quiz on these at the end.

The Life Cycle of Rust Fungi

Rust life cycles are usually complex, with many species having five different stages of fruiting structures and distinct spores on different hosts. The five life-cycle stages in rusts are usually designated as follows:

1. O = spermogonial (pycnial) stage. Haploid (gamete) spores.
2. I = aecial stage. Dikaryotic vegetative spores.
3. II = uredinial stage. Dikaryotic re-infecting spores.
4. III = telial stage. Diploid resting spores that produce stage IV.
5. IV = basidiospore stage. Haploid spores infect alternate host.

Rusts that complete their entire life cycle on one single host plant are called *autoecious* rusts (auto=the same; *ecious*=host), but this is rare. An example of an autoecious rust is Western Gall Rust (*Endocronartium harknessii*). Almost all rusts spend part of their life on one host and the rest of their life on one or more unrelated hosts; these are called *heteroecious* rusts (hetero=different). Usually for heteroecious rusts, the O & I stages are on one host and the II, III, and IV are on an alternate host, but there are variations. Generally each successive stage in the life cycle requires, and is dependent on, the successful completion of the prior stage, or there will be an interruption of the whole process, but there are exceptions.

Macrocyclic rusts go through most or all of the life cycle stages. Microcyclic rusts go through just a couple of the stages and are often on only one host. An example of a microcyclic, autoecious rust is *Chrysomyxa weirii*, a needle parasite on Spruce (*Picea* spp.) trees in North America and Asia.

In Mason Co., Washington, and on the Olympic Peninsula, I find Blueberry Rust almost exclusively on Evergreen Huckleberry. The thickened shiny reddish-brown branches on *Vaccinium* spp. are caused only by stage III. The life cycle is actually missing stage II, but has all the other stages.

Alternate Hosts of Blueberry Rust and Complete Life Cycle

The alternate hosts for the Blueberry Rust's life cycle are the true Firs. In our area it ends up being mostly on Grand Fir (*Abies grandis*), Pacific Silver Fir (*A. amabilis*), Noble Fir (*A. procera*), and Subalpine Fir (*A. lasiocarpa*). It also occurs on California Red Fir (*A. magnifica*) in Oregon and California, as reported by Hepting (1971), and on other species of true Firs in a band across the northern latitudes of the world.

On Fir, Blueberry Rust occurs only on the needles and involves only stages O and I. However, if the infestation is heavy it can cause Witches Brooms as well. The spermogonia (stage O) form on the upper surface of the needle. The aecia (stage I) are obvious, tiny white tubules growing on the undersides of the Fir needles. They form bright orange powdery spores which spread by wind and infect Evergreen Huckleberry plants (Bega, 1978).

The Huckleberry plants then contract the disease and develop telia (stage III), which cause the perennial thickening of the stems called Witches Broom. The diploid telia (stage III) then go through reduction division (meiosis), each forming four haploid basidiospores (stage IV) over time. The basidiospores accordingly are then spread by the wind from the Huckleberry plants and infect Fir trees, starting the life cycle all over again.

Stage I on Firs releases spores during summer to infect the Huckleberry/Blueberry plants. The swollen stems on the Huckleberry bushes caused by stage IV release spores in spring, reinfecting the Fir trees. For details of the microscopic structures as well as keys to both hosts, refer to Hotson (1934), Arthur (1962), and Ziller (1974).

If the life cycle is disturbed or interrupted at any stage, it usually means the rust will not spread to its alternate host and cannot complete the infection process. Blueberry Rust is one of the exceptions, because it has a stage missing. The total infection cycle is

- Fir trees: stages O & I
- Huckleberry/Blueberry (*Vaccinium* sp*p.*) plants: stages III & IV

Stage II is never formed.

Unfortunately, two major plant pathology publications have erroneous information: Westcott (1950, p. 349) and Hepting (1971, pp. 27 & 30) incorrectly state that stage II occurs on *Vaccinium* spp., but there is no stage II at all.

Hypothetically if there were no Fir trees, then the number of newly infected Huckleberry plants would decrease. Likewise, if there were no Huckleberry plants, infection of the Fir trees would not occur, essentially resulting in the downfall of the parasite and a decrease in the damage it causes.

Control of Blueberry Rust

Removal of true Fir trees (the alternate host) from a 500+ yard zone around commercial Blueberry farms has always been an effective measure for controlling the spread of this disease. Infected plants in commercial orchards have to be completely destroyed (dug up and burned) because the disease is systemic (fungus tissue is always present in the stems) and pruning off the larger, obviously swollen areas of the stems does not correct the problem. Once Blueberry plants get the disease, they will always have it. This is in contrast to the alternate host of Fir trees, where it's found only on the needles, which eventually fall off. Therefore, unlike the damage caused to Blueberry and Huckleberry plants, the damage to Fir trees is only seasonal and insignificant. Thus the best method of prevention is to avoid future infection of healthy Blueberry/Huckleberry plants.

cont. on page 6

Blueberry Rust, *cont. from page 5*

The Importance of Understanding the Rust Life Cycle

It is crucial for mycologists to fully understand the intimate and complete life cycles of particular species of rusts, especially those that have a significant economic impact on humans. Knowing the life cycle allows researchers and plant pathologists to look for remedies related to breaking the cycle.

A classic example of this is the Wheat Rust (*Puccinia graminis*). In the 20th Century, before totally resistant strains of wheat were developed, this was a destructive disease. Mycologists knew that the obligate alternate host for Wheat Rust was native Barberry (*Berberis vulgaris*) plants. A massive effort was undertaken to cut down, remove, and destroy Barberry bushes in areas where wheat was grown. As a result, spread of the disease was controlled by eliminating the alternate host.

Most of the rusts in this area are native, but some very nasty species have been introduced. White Pine Blister Rust (*Cronartium ribicola*) is not native to North America. Originally from Asia, it spread to Europe and nurseries in France and Germany which grew seedlings of our Eastern White Pine commercially. The seedlings became infected (unknowingly) and were sold to locations in North America a little before and after 1900. The disease was accidentally brought from France to Vancouver, BC, in 1910 (Ziller, 1974) and spread quickly.

Stage I of White Pine Blister Rust forms large perennial cankers on White Pines. Its alternate hosts are wild currants (*Ribes* sp*p.*), of which we have numerous species. It is so destructive that it has totally wiped out complete stands of Western White Pine in British Columbia. It attacks all five-needle (haploxylon) Pines. In our area, that includes Whitebark Pine (*Pinus albicaulis*) at high elevations. However, there are several other five-needle pines in the Western US that are also attacked. It is well established now in North America and has caused considerable destruction. I'm sorry to say that it's here to stay. This is a sad testimony to what happens when foreign pathogens are introduced. (Although not rusts, Chestnut Blight and Dutch Elm Disease are two more horrendous examples of what happens when you bring in non-native fungal parasites, exposing plants that lack natural resistance.)

There's barely a plant in the world not affected by rusts. Extensive breeding programs to develop resistant strains and hybrids, often with multiple sets of chromosomes, have led to significant progress in overcoming these natural plagues.

I have, perhaps, oversimplified the complexity of these parasites. For a good source of microscopic illustrations of the life-cycle stages in rusts refer to Scott & Chakravorty (1982). An excellent and very thorough discussion of the life cycle of rust fungi (but not illustrated) is given by Petersen (1974).

Food plants, many common ornamental garden plants such as Hollyhocks, forest plants, and weeds such as the Dandelion all have rusts. Rusts are intriguing fungi, and they'll always be around us.

Classification Hierarchy for *Pucciniastrum goeppertianum*

Kingdom Mycota (fungi)
- Division Basidiomycota
  - Class Pucciniomycetes
    - Order Uredinales
      - Family Pucciniaceae
        - Genus *Pucciniastrum*

A great place to look for Witches Brooms here in Washington State is the Blewett Pass road (Hwy. 97) in Kittitas County. Watch the trees carefully (but please watch the road too) and you'll see many Witches Brooms, often in the mid to upper areas of tall conifer trees. My daughter and I used to have a game we'd play to see who could spot the biggest one.

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SHIITAKE RASH

Lisa Sanders

New York Times, Feb. 18, 2011

"Whoa! That is definitely not poison oak," Dr. Walter Larsen blurted as he entered the exam room in his Portland, Oregon, office. The patient smiled ruefully. "I told you," she said to the doctor. The 56-year-old woman had seen Larsen two days earlier. Then she was concerned; now she was scared. She lowered the office gown to reveal scarlet lines crisscrossing up her arms, across her neck, down her back, chest and abdomen. Larsen didn't know what this rash was, but it sure had become a lot uglier in just a couple of days.

The patient first saw the rash on Monday. At that point, it was confined mostly to the back of her hands and didn't really hurt or itch. By the end of the day though, the rash had become redder and angrier-looking. Overnight, tiny blisters formed over the red regions. When her sister saw her hands, she was concerned. "You've got to see a doctor about this."

At her first visit, Larsen suspected that it was some kind of allergic contact dermatitis, probably from a plant like poison oak. He asked the patient if she had been outdoors within the past few days. She told him she visited a friend's farm and picked Swiss chard over the weekend, but she didn't see any poison oak. Nevertheless, that seemed to cinch it—at least for the doctor.

The patient wasn't convinced. She'd never had a reaction to poison oak before. Larsen gave her a steroid cream to use and suggested that she come back in a couple of days.

Now, two days later, she was back, and Larsen was stumped. The little blisters he noted on her hands initially had hardened, and the red streaks were much darker, almost purple, and raised. The way those welts now streaked across her neck, back, legs, and abdomen made it look as if she had been flogged.

The red streaks looked like excoriations from vigorous scratching, but she told him that she hadn't been. Besides, she had this rash on the middle of her back, where she couldn't even reach.

Had she started taking any new medicines recently? An allergic drug reaction could cause this kind of whole-body rash—but he'd never seen one like this. She shook her head: no new medications. There was no fever and no symptoms other than the rash. That made an infection unlikely.

Larsen left the room, returning a few minutes later with two of his younger partners. After a long moment, one of the partners, Dr. Michael Adler, asked the patient whether she had eaten any shiitake mushrooms recently. "How did you know?" she asked. On Friday, three days before the rash appeared, she was offered a sample of shiitakes cooked in oil and garlic at her local grocery store.

The three walked out of the room. Finally Larsen returned. "We think this is a classic reaction to raw or undercooked shiitake mushrooms," Larsen told her.

Shiitake dermatitis, as it's known in medical jargon, was first described in 1977. Since then, it has been frequently reported in Asia, though rarely in the U.S. The rash is thought to be a toxic reaction to a starchlike component of shiitake known as lentinan. Lentinan breaks down with heat, so the rash is seen only when the mushrooms are eaten raw or partly cooked. Current thinking is that something in the lentinan triggers blood vessels to dilate and leak small amounts of inflammatory compounds just beneath the skin.

Not everyone has this kind of violent reaction to raw shiitakes. In one study, just over 500 patients were exposed to an intravenous version of lentinan. Nine developed this streaky rash. The others had no response. Why it creates these whiplike streaks in some is not well understood. A rash with a similar pattern has been linked to bleomycin, a chemotherapeutic medication.

Larsen ordered a biopsy of the rash to make sure they weren't missing anything, and he instructed the patient to continue to use the steroid cream at home. The cream helped, but it took weeks for the rash to fade completely.

Larsen recommended she avoid uncooked shiitakes. "I'm never going to touch another shiitake," the patient told him. "I don't care if they are good for you. One of these rashes was enough."

UPDATE ON US STAMP WITH A MUSHROOM

Brian Luther

The sheet of US postage stamps entitled "Hawaiian Rain Forest"—described in detail in February 2010 (B. Luther, *Spore Prints 459*, pp. 4–5)—was issued by the US Postal Service on September 1, 2010, and is now available at post offices for $4.44. This colorful sheet (Scott Catalog No. 4474a–j) contains a mushroom tentatively identified by mycologist Dennis Desjardin as *Hygrocybe noelokelani* based on the bright pink color and habitat.

STUDY TRACES MOREL MUSHROOMS BACK TO DAYS OF THE DINOSAUR

Leslie Cole

The Oregonian, Mar. 15, 2011

Now that spring is in the air, our minds are turning to morels. And thanks to a new study published in *Fungal Genetics and Biology* (you do subscribe, yes?), we can swoon over this honeycomb-capped fungi with a little more knowledge.

It turns out morels have been on the planet since the time of the dinosaurs, splitting off from other fungal species 129 million years ago at the beginning of the Cretaceous period. Since then, morels have evolved into 177 related species, and western North America—particularly the Pacific Northwest—has been an evolutionary hot spot.

"Oddly enough, most animal species aren't particularly attracted to morels," says Oregon State University researcher Nancy Weber, who participated in the study. "A few slugs and other things will eat them. But humans have probably been eating them for about as long as there have been humans."

The newly published genetic analysis, one of the most detailed ever done, also suggests what conservation efforts will be needed to protect the morel for centuries to come. As to what accounts for their exceptional deliciousness when sautéed in butter, that's a research question we'll be happy to investigate.

Epitaph on a tombstone in North Scotland

Come bide a wee,
And sit with me
Upon my tombstone long.
The key die lee,
Though it may be
I did but read it wrong.

WILD MUSHROOM BREAD PUDDING

served at the beginning of a Monday ID class

1 medium onion, sliced
2 garlic cloves, minced
1 TBs butter
8 oz. coarsely chopped wild mushrooms
2 cups whole milk or cream
2 eggs
½ tsp salt
¼ tsp pepper
½ tsp rosemary
4 cups packed 1-in. cubed bread
¼ cup shredded Parmesan cheese

Preheat oven to 350ºF.

In a saucepan over medium heat, sauté onion and garlic in butter. Add the mushrooms and cook until soft.

Whisk together the milk or cream, eggs, salt, pepper, and rosemary. Add the cubed bread and let it soak 20 minutes. Once the bread has absorbed most of the liquid, add the mushroom mixture and cheese, and stir together.

Bake in a 10-in. dish for about 45 min. or until a knife inserted comes out clean. (*serves 6*)

Survivors Banquet











Pictures by John Goldman

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