SPORE PRINTS

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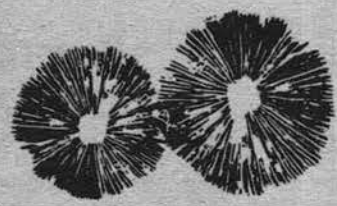

CULTIVATED MUSHROOMS

Ray Zilinskas
Potomac Sporophore, XIV, Dec. 1994

Of the approximately 15,000 species in the class Basidiomycetes, fewer than 50 are cultured commercially somewhere in the world.

The first recorded mushroom to be cultured was a species of *Auricularia auricula* (Woody Ear) in China about 1,400 years ago. The second was *Flammulina velutipes* (Winter Mushroom), also in China, about 800 AD. The third was *Lentinus edodes* (Shiitake or Black Forest Mushroom) in China about 900 years ago. The fourth, *Volvariella volvacea* (Straw Mushroom), was domesticated in Kwangtung Province, China, about 300 years ago. *Agaricus bisporus* (Button Mushroom), the ubiquitous mushroom found in our markets, was first cultured in France in 1650. Of all the mushrooms sold commercially, the one produced in largest quantity is *Agaricus bisporus* (68% of the total), and it also is the most widely cultivated (over 100 countries). The largest producers of *A. bisporus*, in descending order of importance, are the U.S., France, China, Netherlands, and U.K. Second place is held by *Lentinus edodes* (16%), which is produced mostly in five Asian countries (Japan, China, Taiwan, Korea, and Thailand); third is *Volvariella volvacea* (5%) in China, Taiwan, Thailand, etc.; fourth is *Flammulina velutipes* at about 4% in Asia; fifth is *Auricularia auricula*; sixth is *Pleurotus* spp. (Oyster Mushroom); seventh is *Pholiota nameko* ("Nameko" or Viscid Mushroom); eighth is *Tremella fuciformis* (White Jelly Fungus or Silver Ear); and ninth is *Tuber* spp. (Truffles).

The country having the largest number of cultured species is China, where about 30 species are already being cultured and an additional 20 or so are in the process of being domesticated.

MUSHROOM CROUSTADES

Bob Hosh
NJMAnews, Nov.–Dec. 1994

- 1 lb white button mushrooms, cleaned
- 2 oz. dried morels
- 3 TBs minced shallots
- 1 clove minced garlic
- 1 TBs ground coriander
- 2 TBs minced parsley
- 2 TBs sherry
- 3 TBs butter
- 1 TBs Kitchen Bouquet (optional)
- Salt and pepper to taste
- 1/4 C sour cream
- 1/3 C brown sauce, or Heinz au jus Homestyle Gravy

Reconstitute the dried morels in 1/2 C boiling water for 15 minutes. Drain and reserve the liquid. In a food processor, mince the store-bought mushrooms and the morels together. Melt the butter in a sauce pan, add shallots and garlic. Sauté 3 to 4 minutes. Add mushrooms and sauté until liquid has evaporated. Add brown sauce, sour cream, sherry, and Kitchen Bouquet. Add coriander, parsley, salt, and pepper. If too thick, add some of the reserved morel soaking liquid. Simmer until mixture is fairly thick. Slice a loaf of French baguette into 1/2-in. thick oval slices. Spread the mixture on the slices. Place on an ungreased cookie sheet and bake in a 400°F oven for about 10 to 12 minutes. Serve hot.

WAIT, THERE'S A FLY IN MY MUSHROOM!

Hannah Nadel, South Vancouver Island Myco. Soc.

On a recent trip to the southern interior of British Columbia, I noticed Oluna Ceska, who seems sane enough, patting *Leccinum* mushrooms. She then either picked the mushroom with a triumphant cry or muttered sounds of disappointment and moved quickly on.

Rather than pick the mushroom, cut it open, and examine its flesh, Oluna has learned that a mushroom that feels firm to the touch is relatively worm free, and that those that feel spongy or punky are riddled with worm burrows. She can test this with one or two quick pats, lessening the time spent searching for good edibles.

But this story is not about time management in the life of a B.C. mushroom eater. Rather, it touches on the all-to-familiar "worms" that can turn a mushroom-eater's delight to dolour, and a mushroom to—mush.

They're Not "Worms"

First of all, like many things that are not what they seem to be, the worm-like creatures burrowing through your mushroom are not worms. They are insects. More specifically, they are the young of flies or, sometimes, beetles. These insects start their lives as eggs which hatch into larvae, undergo a resting stage, or pupa, and turn into winged adults (other insects change from larvae directly to adults). All growth occurs during the larval stage, and it's therefore no surprise that this stage is the most voracious. These eating-machines enlarge and fatten, periodically shedding their skin as they outgrow it and finally moulting into a resting pupal stage during which they metamorphose into winged adults. After escaping from the pupal skin, the adults may or may not feed, depending on the species, and they do not shed their skin again. They don't grow, although the females may expand while carrying eggs.

Flies

Fungus Gnats. In B.C., and probably in most of North America, the commonest fly larvae, or maggots, that you'll find feeding in mushrooms belong to the fungus gnat family, the Mycetophilidae (pronounced my-see-toe-*fill*-id-ee, from the Greek words for fungus—*mykes*—and lover—*phileo*). They are not hard to distinguish from other maggots in mushrooms because they have very dark heads and strong constrictions along their pale bodies. Like many other maggots, they are soft and thin skinned, which makes them vulnerable to drying. Living inside a moist mushroom, or, in other cases, in rotting vegetation, protects them from drying and provides them with plenty of fungal tissue to feast on. The eggs are laid directly on the mushroom, usually on the underside in the spaces between the gills or in the pores (depending on what the mushroom has), and within a day or two the tiny hatchlings begin feeding on these structures. At this stage the mushroom is still perfectly edible and the cap is firm. As they grow, the legless larvae burrow into the flesh of the stem and cap

Cont. on Page 3

Spore Prints

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PUGET SOUND MYCOLOGICAL SOCIETY

Center for Urban Horticulture, Mail Stop GF-15
University of Washington, Seattle, Washington 98195
(206) 522-6031

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EDITOR:	Agnes A. Sieger, 15555 14th Ave. N.E Seattle, WA 98155

CALENDAR

Jan. 10	Membership meeting, 7:30 PM, CUH
Jan. 15	Cultivation Group, 1:00 PM, CUH
Jan. 16	Board meeting, 7:30 PM, CUH
Jan. 27	*Spore Prints* deadline

CULTIVATION GROUP — Greg Chew

It's the beginning of the new year and time to explore new horizons. In the first quarter of the year, the Cultivation Group will be helping members get started in cultivation studies. An introductory cultivation class is being prepared for offering in March.

The January and February meetings will be held at the Center for Urban Horticulture. The January meeting will be Sunday, the 15th, at 1:00 PM. The agenda will be to look at the tools and equipment used in cultivation studies. Items available to and suitable for home cultivation will be presented. A sample of available sources and prices will be discussed. The February meeting will center on fungal nutrition and the preparation of culture media. This meeting will be February 12 at 1:00 PM.

IN THE NEWS — Dick Sieger

Iceman Update

Scientists at the University of Innsbruck, Austria, claim to have germinated 5,300-year-old-fungus spores recovered from straw insulation in shoes of the "Iceman." According to a translation from *Continental Reporter* made for the Oregon Mycological Society's newsletter *Mush Rumors,* the species were *Absidia corymbifera* and *Chaetomium globosum.*

Maybe. Mycologist Edmund Tylutki once tried to revive mycelium from fossils. When he was extremely careful to avoid fun-

Cont. on next column

MEMBERSHIP MEETING

Tuesday, January 10, 1995, at 7:30 PM in the Center for Urban Horticulture, 3501 N.E. 41st Street, Seattle

Our January program will feature PSMS Scientific Advisor Dr. Joseph F. Ammirati, who will speak on "An Update on Washington Fungi—the Barlow Pass Study, Toxicology, History, and More." Dr. Ammirati is Chair of the Botany Department at the University of Washington. His revision of *The New Savory Wild Mushroom* earned him a certificate of achievement from the Society for Technical Communication. Dr. Ammirati is a constant supporter of mushroom hobbyists, speaking at numerous meetings, banquets, and forays. He directs our Barlow Pass old growth study and is advisor to the Pacific Northwest Key Council. Professionally, he is respected for his work with *Cortinarius*, toxicology, and forest ecology.

Will persons whose last names begin with N–Q please bring a plate of refreshments for the social hour?

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cont.

gal contamination, no fungi developed. He shared some material with a bacteriologist who was extremely careful to avoid bacterial contamination. The bacteriologist, of course, got a healthy growth of fungi and no bacteria.

Bam! What was that?

Pilobolus, a widespread genus of fungi barely visible to the naked eye, uses a hydraulic launcher to propel its tiny spore packet. The packet travels 45 miles per hour after the first millimeter of flight, the second highest acceleration in nature. (*Hydra*, a marine invertebrate, fires a tiny spear at four times that acceleration.)

Dry Rot

Dr. Jagjit Singh just returned from a remote part of the Himalayas north of Delhi with specimens of *Serpula lacrimans*, the dry rot fungus. He says the fungus grows naturally in that part of the world only. "If we can discover the secrets of the fungal growth in the wild we will be well on the way to developing natural methods of suppressing or eliminating it in our buildings." Dry rot is an insidious disease of damp buildings and wooden ships. God gave Moses and Aaron specific instructions for treating fungus-infested houses (*Leviticus* 14:33–54).

Prison Population Mushrooms

Eight inmates in a Northallerton, England, remand centre will produce up to 100,000 pounds of mushrooms. Selling the mushrooms to wholesalers will reduce the cost of the prison.

Dutch Elm Disease

Clive Brasier, a British scientist, discovered an aggressive new strain of *Ceratocystis ulmi*, the fungus that causes Dutch elm disease. He collected it in a remote Indian forest in the western Himalayas. It may be a strain from which the current Dutch elm disease evolved. The new strain could be a new threat to elms but could also provide clues for controlling the disease. Trees in the area are not infected, perhaps because local parasites or viruses attack either the fungus or the bark beetles that spread it.

The Lepiota *with the pale green gills*
Has a poison, though not one which kills.
It generally spawns on summertime lawns
And causes retching, diarrhea, and chills.

— R.E. Reinert, *Mush Rumors*

Wait, There's a Fly, *cont. from p. 1*

and literally eat themselves out of house and home. The burrows fill with digestive waste and can be invaded by bacteria and other fungi; at this stage, the burrows generally appear rather brown or yellowish and the mushroom shouldn't be eaten.

When ready to pupate, after a week or so, fungus gnat larvae usually leave the rubble of the mushroom and burrow in the soil below it. After a few days, the dark, mosquito-like adults emerge and mate, and the females smell their way to a new mushroom on which to lay eggs. They usually prefer young mushrooms, perhaps because these will last longer and also probably because they're racing against other fungus gnats (and other insects) to provide their own offspring with the advantage of being the first on a limited island of food.

Pomace Flies. Other maggots you might encounter in a mushroom are the smoother-bodied and pointy-headed relatives of the small flies that visit your fruit bowl at home and feature in your genetics class at school. This family of flies is the Drosophilidae (pronounced dro-soh-*fill*-id-ee, from the Greek words for dew or sap—*drosos*—and lover—*phileo*), also known as pomace flies or even as fruit flies, although they mustn't be confused with the true fruit flies (family Tephritidae). Larvae of pomace flies feed on fungi in rotting vegetation, fruit, sap flows on trees, or directly in mushrooms. Their life cycles resemble those of fungus gnats, so I won't dwell on them further except to mention that their pupal cases are cylindrical, unlike the next family of flies. Adult fruit flies are quite different from the mosquito-like fungus gnats, being shaped more like a common house fly, but much smaller and usually coloured a shiny honey-brown. Those of you who have studied genetics in school will remember the famous "fruit fly," *Drosophila melanogaster,* the laboratory rat of the insect world, whose giant salivary-gland chromosomes and rapid reproduction have made it the darling among geneticists. The larvae of this species feed on fungi in rotting fruits. The adults carry fungi or spores on their feet to inoculate ripe, newly bruised fruit on which they will lay eggs.

Flat-Footed Flies. The Platypezidae (platey-*peez*-id-ee, from the Greek *platys*—flat—and *peza*—foot), or flat-footed flies, are easiest to recognize in the pupal stage. The pupal cases are flat rather than cylindrical, with seemingly toothed edges. The adults are small and black, often with flat leg segments, and also resemble minute house flies rather than mosquitoes.

Dark Winged Fungus Flies. Many other families of flies feed at least partly on fungi, sometimes on mushrooms but most often on fungi that cause decay in plant material or dung. The dark-winged fungus gnats, family Sciaridae (see-ar-id-ee, from the Greek *skiaros*—shady, because they like shade), are often reported as pests in commercial mushroom houses. They also feed on fungi in decaying plant material such as rotting roots, which is why you might see hordes of them around your overwatered potted plants at home and in greenhouses. They are rather mosquito-like, delicate, and often minute, with dark grey wings.

Beetles

Like flies, many families of beetles are feeders on fungi. Some of them are very beautiful, as is reflected in names like "handsome fungus beetles" and "pleasing fungus beetles." Some feed on mushrooms, but many can handle the tougher woody bracket fungi and other polypores. Unlike flies, the adults often feed on the same stuff as their larvae, and these two stages can be found together in one mushroom. Adult beetles are generally hard-bodied, with a pair of hard outer wings that fit closely over the back like a shell (the soft, transparent flight wings are folded under the protective wings and are not usually visible). The larvae are often worm-like, but, unlike maggots, they have three pairs of legs on the underside just behind the head, and the head is hard, usually brown, and armed with two visible teeth (use your magnifying glass!). The pupa may be in the fungus or outside, depending on the beetle species. The life cycle of beetles is generally much longer than that of flies, but some can develop from egg to pupa during the short life of a soft mushroom.

In B.C. you might, through diligent search, find beetles of a least 10 families in soft mushrooms and in the harder brackets or other fruiting bodies. Many are rare. The showiest are the handsome fungus beetles (family Endomychidae, pronounced endo-*my*-kid-ee, from the Greek *endon*—within—and *mychos*—innermost recess; the meaning escapes me), and the pleasing fungus beetles (family Erotylidae, pronounced ero-*till*-id-ee, for which I can't find any word origins that make sense at all!). These striking beetles are shiny and patterned with black mixed with red, orange, and/or yellow. The handsome fungus beetles are usually smaller but can reach one centimeter in length, about half the size of the pleasing fungus beetles. If your mushroom has a drab beetle up to half a centimeter in length with spiny-looking margins on its "neck," it's probably a tooth-necked fungus beetle (family Derodontidae, pronounced dare-oh-*don*-tid-ee, from the Greek *deros*—skin—and *odontos*—tooth). A long, slender, flexible beetle with short outer wings would be a rove beetle (family Staphylinidae, pronounced staff-illin-id-ee, from the Greek *staphylinos*—an insect), usually found among the gills rather than in the flesh of the mushroom. Other families include an array of small, drab beetles fondly known as LBJs (Little Brown Jobs), just like the LBMs (Little Brown Mushrooms) we love to ignore in the mushroom world. Some tooth-necked fungus beetles and round fungus beetles (which can curl up into a ball) feed on slime molds.

Enter The Good Gals

Now we know more or less who in the insect world is eating our mushrooms. But it's not enough that our delicacies are full of flies and beetles, they have a variety of minute wasps, too! These, however, are not joining in the feast; rather, they are parasitizing and killing the fungus-eaters. They are the good gals, the natural controlling agents that help keep the world from turning into one huge, wriggling, buzzing mass of insects. These tiny wasps, usually one to four millimeters long, do not sting and have no interest at all in humans. We, however, should be kissing the ground under each of their six little feet!

Wasps that parasitize mushroom eaters usually find mushrooms by smell, after which they search for eggs, larvae, or pupae of flies or beetles either by feel, vibrations, or again by smell. They have a long, hollow, threadlike structure on their rear end through which the eggs are laid on the victim (host) or inside it. The eggs hatch and the wasp larvae feed on the host insect, eventually killing it. The wasp larvae then pupate before turning into delicate, wasp-waisted adults. You might find the wasps as unsavoury as the other insects in your mushroom, but remember that by killing many of the flies and beetles, the wasps prevent them from multiplying without check and infesting every single fungus on Earth. Also, they don't harm uninfested fungi. There are several families of parasitic wasps saving our mushrooms, and millions of species that parasitize and kill insects in our homes, gardens, fields, forests, and waters.

Soon, it will be time to wake up from the winter doldrums, go out, and pat the mushrooms. But just remember that, while most of you are leaving the punky mushrooms alone, at least one deranged individual will be following you and picking precisely those mushrooms which you've patted and left behind.

THANKS FOR ALL YOUR WORK

Judith Rubin

Judith Rubin
382 North Ave. #7
Burlington, VT 05401

Dear Ms. Velategui:

I'm writing to enthusiastically renew my membership with PSMS.

You may think it odd that someone in Vermont would like to receive information about Puget Sound mycology; I am a Master's student (Botany/Field Science) at the university here, but look longingly forward to returning to Puget Sound after my stint here is through.

I went out on a foray with the [local] mushroom group and realized I had been spoiled by the professionalism and thorough care of PSMS. I found that the group was only interested in edibles—not in ecology, conservation, safety or art. Indeed when they found fungi to pick, they took every last one they could find! I thought back to the forays with PSMS and the emphasis on ID, to the members who told me, "You can call any time if you're unsure of identification," and to the creativity of the members of PSMS.

To my surprise, a few of my colleagues here are a bit fungiphobic. So I'm showing them the beauty and ecological importance of the humble mushroom.

Thanks for all your work.

Sincerely,

Judith Rubin

Credits for the 1994 Annual Exhibit Poster: Neil Kvern of Seattle Imagesetting donated 100% of the digital prepress work. Academy Press donated 25% of the printing costs.

VOCABULARY QUIZ

Mycena News, Fall 1994

1. The stalk that supports the cap	a. Annulus
2. Another name for the cap	b. Areolate
3. Another name for the gills	c. Cespitose
4. The spore-bearing tissue layer	d. Context
5. The inner substance of the cap or stalk	e. Cortina
6. Located near the top of the stalk	f. Floccose
7. The ring which shows on the stalk	g. Glabrous
8. A cobwebby veil	h. Glutinous
9. Netted pattern	i. Hirsute
10. Extending down the stalk	j. Hispid
11. Lacking a stalk and attached by the cap	k. Hymenium
12. Lacking a stalk; spread on the substrate	l. Lamellae
13. Cap with abruptly raised center	m. Lignicolous
14. Cap bald	n. Pileus
15. Cap covered with a fine powder	o. Pruinose
16. Having minute hairs	p. Pubescent
17. Having a covering of soft, matted hairs	q. Resupinate
18. Having long hairs	r. Reticulate
19. Having stiff hairs or bristles	s. Rimose
20. Having tufts of woolly material	t. Rugose
21. Having small scales	u. Sessile
22. Wrinkled	v. Stipe
23. Very slimy; oozing in wet weather	w. Striate
24. Having small cracks	x. Squamulose
25. Sticky or tacky to the touch	y. Superior
26. Divided into small areas by deep cracks	z. Terrestrial
27. Having delicate radial grooves	aa. Tomentose
28. Growing on wood	bb. Umbonate
29. Growing on the ground	cc. Viscid
30. Growing in clusters	dd. Decurrent

1-v, 2-n, 3-l, 4-k, 5-d, 6-y, 7-a, 8-e, 9-r, 10-dd, 11-u, 12-q, 13-bb, 14-g, 15-o, 16-p, 17-aa, 18-i, 19-j, 20-f, 21-x, 22-t, 23-h, 24-s, 25-cc, 26-b, 27-w, 28-m, 29-z, 30-c.

Happy New Year

Puget Sound Mycological Society
Center for Urban Horticulture
GF-15, University of Washington
Seattle, Washington 98195

RAFANELLI, George & Jennie
1776 S. Columbian Way
Seattle, WA 98108