

SPORE PRINTS



BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY
Number 230 March 1987

MUSHROOM CULTIVATION

Agnes Sieger

Although the Japanese have cultivated shiitake for 2000 years, the earliest record of European mushroom cultivation was in the 17th century when Olivier de Serres, an agronomist to Louis XIV, retrieved wild specimens and implanted mushroom mycelium in prepared substrates. At first, mushroom growing was a small-scale outdoor activity. Materials in which mushrooms grew naturally were collected and concentrated into prepared beds which, in turn, were cropped and then used to start new beds. As demand increased and new methods improved yields, mushroom growing developed into a large-scale commercial business complete with computer-controlled indoor environments and scientifically formulated substrates. Spawn with which to plant prepared beds, initially gathered in nature, became standardized as sterile culture techniques were perfected.

With the growing interest in wild mushrooms and their increasing appearance in the American marketplace has come an interest in home cultivation. Most mycological societies now have a cultivation group, usually a enthusiastic one. (PSMS lags other societies in this respect.) Catering to this new interest is a rash of entrepreneurs like the Full Moon Company, whose booth was so popular at the Annual Exhibit last October, dedicated to making home cultivation as easy as possible.

Techniques for cultivating mushrooms, whatever the species, follow the same basic pattern: (1) collection and germination of spores and isolation of mycelium (or tissue cloning); (2) preparation of an inoculum by expanding the mycelial mass on an enriched agar media and then on grain and implanting the grain spawn into composted and uncomposted substrates or using the grain itself as a fruiting substrate; (3) initiation and development of the fruiting bodies.

With many species, moderate crops can be produced on cased grain cultures, or the cultivator can go one step further and inoculate compost, straw, or wood. In either case, the fruiting of mushrooms requires a high-humidity environment that can be readily controlled. It also requires care against contamination by other microorganisms, whether they be competing fungi, bacteria, viruses, or plants.

Some species suggested for cultivation under controlled conditions are *Agaricus bisporus* (on compost or rye grains), *Agaricus subrufescens* (on compost), *Flammulina velutipes* (on sawdust/bran), *Pleurotus ostreatus* (straw), *Lentinus edodes* (logs or sawdust), and *Stropharia rugosoannulata* (straw/sawdust). "Controlled conditions" does not imply a high order of technical expertise, expensive equipment, or intensive labor. It does mean that one has the desire (and space) to give the babies a little tender loving care. That means attention to growing parameters; *Pleurotus ostreatus* var. *Florida*, for example, prefers temperatures in the 70's whereas its close cousin *Pleurotus ostreatus* likes the low 60's.

Some species suggested for cultivation by "natural" methods, i.e., increasing the odds by giving nature a hand, are *Agaricus subrufescens*, *Clitocybe (Lepista) nuda*, and *Stropharia rugosoannulata*.

Agaricus subrufescens, the almond agaric, is an excellent species for companionate planting in the garden. See *Organic Gardening*, January 1984, for details and spawn source.

Clitocybe nuda, the blewit, provides an excellent answer for what to do with those fall leaves. Put them in a pit and mulch them. Add some hardwood sawdust or chips for additional nutrient and inoculate. Water occasionally over the summer and look for fruiting bodies in the late fall. If they don't show up the first year, don't despair; they might just pop up the next.

Stropharia rugosoannulata, the wine-cap *Stropharia*, requires a similar technique but a straw and wood-chip substrate. They're cranky, but success will result in a yield of delicious mushrooms weighing up to 2 lb with diameters to 10 in.

NOTES ON GYROMITRA

Dick Sieger

Twice in one week I identified *Gyromitra korfii* as oversize *Gyromitra esculenta*. Dr. Ammirati set me straight and assigned homework. Here is what I learned.

Six stalked *Gyromitra* species can be found in our Pacific Northwest: *G. esculenta*, *G. californica*, *G. gigas*, *G. korfii*, *G. infula*, *G. ambigua*. The first four are spring mushrooms and the latter two appear in the fall. Their seasons may overlap, however, and a lucky collector could have fresh specimens of all six at one time.

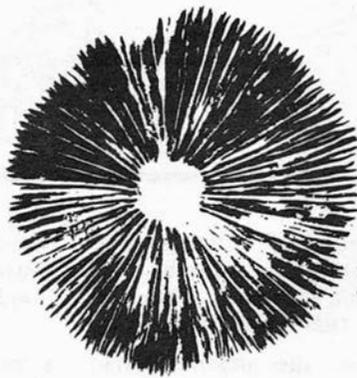
G. esculenta fruits in forests with the morels. Caps are an inch across with occasional six-inch giants showing up. The cap is brain-like--rounded and covered with little bumps that aren't arranged in any noticeable pattern. If you cut across the stalk near its middle, you will usually see one open chamber; however, if several fused stalks support the cap, there may be more than one. The stalk is clean except for a little dirt right where it is attached to the ground.

On *G. californica* the cap margin is remote from the stalk and apparently held open by ridges extending from the stalk. It's shaped like an open umbrella that the puppy chewed. The bottom of the stalk often has a spot with a reddish stain.

G. ambigua and *G. infula* look alike. Microscopic examination may be the only way to distinguish one from the other. The spores of *G. ambigua* have blunt projections that make the ends somewhat narrow. Most are 22 to 28 microns long, and the L/D (length divided by diameter) is more than 2.5. *G. infula* spores have rounded ends, are mainly 16 to 22 microns

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PSMS

Spore Prints

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Calendar

- Mar. 15 Annual Survivors' Banquet, Wang's Garden Restaurant, 1644 140th Ave. NE, Bellevue
- Mar. 16 PSMS Board meeting, 7:00 p.m., Center for Urban Horticulture
- Mar. 21 Educational field trip to MacDonald County Park near Carnation, 9:30 a.m.
- Mar. 27 Deadline for preferred registration for beginners' identification classes
- Apr. 3 *Spore Prints* Deadline
- Apr. 4, 5 Field Trip to Steelhead County Park, Rockport
- Apr. 6 Mushroom identification assistance, 3:00 to 7:00 p.m., PSMS office/library, CUH
- Apr. 7 Beginners' identification class, 7:15 p.m., CUH
- Apr. 13 Mushroom identification assistance, 3:00 to 7:00 p.m., PSMS office/library, CUH
- Apr. 14 Beginners' identification class, 7:30 p.m., CUH

23rd ANNUAL SURVIVORS' BANQUET Dennis Bowman

This year's banquet is a twelve-course Chinese feast at Wang's Garden Restaurant, 1644 140th Ave. N.E., Bellevue. The banquet will be preceded by a no-host social hour, which will begin at 6:30 p.m. on Sunday, March 15.

FIELD TRIPS Andy Green

We urge those of you who are new to PSMS to attend the field trips if you can. Most are scheduled for two days, and people come and go as they please. Some stay overnight; some just stay for the day. Register with the hosts when you arrive, and be sure to stay over for the potluck Saturday afternoon. To participate, bring one dish (hot dish, salad, or dessert) to feed the number of persons in your party. PSMS furnishes coffee.

One or more hosts will be at each field trip all day to welcome our members, give them encouragement, send them out to collecting sites, keep them warm with coffee, and sustain them with cookies. There is also an identifier to identify your finds. New members should try to arrive by 9:00 a.m., so they can be taken along by an experienced member.

MacDonald Park March 21, 1987
This is a learning field trip scheduled for Saturday only. MacDonald Park is located a half mile south of Carnation in King County. Enter the park via N.E. 40th Street from Highway #203 and go to the parking lot for the day-use area. Cross the suspension bridge to get to the shelter on the west side of the river. There will be a lecture by Monty Hendrickson at 9:30 a.m., followed by a hunt for *Verpa bohemica*.

Rockport April 4, 1987
This is a regular spring field trip. You may camp in this beautiful campground located on the Skagit River. There are full hookups, if desired, for the customary fee. There are two possible routes, both lined with cottonwoods, so you can look for *Verpa bohemica* on the way. Either take the Arlington exit #208 from I-5 and drive through Darrington, or take the Burlington exit #230 to Rockport. Steelhead Park is on the river bank. Bring your binoculars, because if we are lucky we may see some bald eagles.

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|----------|-------------------------------------|
| March 21 | MacDonald Park, Carnation |
| April 4 | Steelhead Park, Rockport |
| April 25 | unconfirmed trip to mushroom grower |
| May 2 | 29 Pines, Teanaway |
| May 9 | Lake Wenatchee State Park |
| May 16 | Soda Springs Campground |
| May 23, | Clear Lake Campground |
| May 30 | Swauk Creek Campground |
| June 13 | Crystal Springs Campground |

BOARD NEWS Betty Hamilton

Coleman reported that he is looking for volunteers to man the library on Thursdays and Fridays, in addition to 3:00 - 7:00 p.m. on Mondays and 6:30 - 8:30 or 9:00 p.m. on Wednesdays. Dennis Bowman suggested that PSMS hold a summer picnic, so people could get together during the off season. The Board voted three scholarships of \$200 each to students selected by Dr. Ammirati. They are Mitchell D. McGuinness, George J. Mueller, and Steve Rehner.

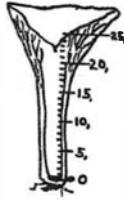
Most of the rest of the meeting was spent discussing possible fund-raising activities.

Mushroom Identification: The library will be open for mushroom identification from 3:00 - 7:00 p.m. on Mondays EXCEPT for the week of Memorial Day (May 25th), when the library will be open on Tuesday, the 26th.

Beginners' Class: Sign up soon for the spring beginners' class by calling Coleman at 322-2554. There will be six sessions on Tuesdays (April 7, 14, and 21 and May 5, 12, and 19) at the PSMS office building at CUH. The fee is \$16.

New Officers: Remember, the newly elected officers are expected to attend the board meeting on March 16, 7:00 p.m., at CUH -- the day after the election results are announced at the Survivor's Banquet. (We believe in breaking 'em in quick.) Alternates are encouraged to participate.

Building Fund: We now have about \$900 in the building fund. Thank you for your generosity. Send your contributions to Edith Godar, PSMS Treasurer, 11704 103rd N.E., Kirkland, WA 98034. Many fund-raising activities have been suggested. A summary will be available within a month or so.



CONSERVATION AND ECOLOGY

Margaret Dilly

Last month I wrote about HB 275 and SB 5137. The third bill I spoke of still has no number, nor has it been introduced. The sponsor is Representative Grace Cole, and it would fall under the direction of the Department of Agriculture. The bill as it reads would require a \$50 permit for a buyer and a \$250 permit for processors to enable them to purchase wild mushrooms. It would also require the buyer to collect information as to area, species, and amounts gathered. This information is to be turned over to the processor who in turn would report to the state at year's end.

The bill sounds good on the surface, but it is really fraught with problems. (1) It allows the processor complete control over the harvest. (2) The processor is given the vehicle to manipulate both the buyer and the state. (3) All transactions are cash deals, and no audit provision is addressed. (4) The fee structure is unfair to the *small* processor; The dollar amount is but a drop in the bucket to the *big* processor. (5) It does nothing to protect the landowner's rights (which could possibly be profit for him or her). (6) It does not ensure accurate information gathering, since no provision is made for audit or book inspection. (7) It would do nothing to reduce or regulate the harvest.

The intention of this bill is good, but rather than a foot in the door dealing with mushroom harvest, it would put a large club in the hands of those who would use it against our honest efforts to regulate and preserve the wild edible mushroom.

What we really need is a mushroom commission that deals with every aspect of commercial harvest. In the meantime, let us do what we can with the bills at hand, HB 275 and SB 5137, while you all have your lists of legislators' addresses and phone numbers. The ZIP in Olympia is 98504.

Keep contacting them! NOW!!!! The hot line number is 1-800-562-6000.

long, and have an L/D less than 2.5. Both species have contorted caps that are folded like fortune cookies. Elves leave messages in them. *G. ambigua* fruits on bare soil and disturbed ground. Its cap is supposed to have violet tints that are lacking in *G. infula*. *G. infula* grows on rotting wood, woody debris, and humus.

We have two large species of *Gyromitra* with fat stalks; *G. gigas* and *G. korfii*. *G. gigas* often grows near, or right through, melting snow. As you already know, I'm not too familiar with *G. korfii*. The ones I saw were darker than *G. gigas*. The stalks on *G. korfii* are noticeably narrower than the cap whereas those on *G. gigas* are almost as broad as the cap. Slice across the stalk and you will see that both species have stalks with many compressed, sinuous chambers that contain dirt.

The *Gyromitra* cap starts as a regular disc. Soon, different growth rates in different parts of the cap create an irregular shape. If development doesn't proceed normally, an atypical shape is produced and that can make field identification difficult.

The 1972 edition of *How to Know the Non-Gilled Mushrooms* by Smith, Smith, and Weber describes all six species with the names used here. Older field guides may use other names. The best descriptions, using correct names, good keys, and fine photos, are in *Poisonous Mushrooms of the Northern U. S. and Canada* by Ammirati, Traquair, and Horgen.

Some American *Gyromitra* species that were thought to be the same as European ones are now known to be different. What I am calling *Gyromitra korfii* has been known as *Gyromitra fastigiata*. North America does have a *Gyromitra fastigiata*, but it is not known from around here. Confused yet? Just wait. Until recently, the true *Gyromitra fastigiata* was known by two other names, *Gyromitra brunnea* and *Gyromitra underwoodia*. Finally, what I am calling *Gyromitra gigas* is being called *Gyromitra montana* in Europe. Wow, you can't tell the players without a scorecard!

NORTHWEST GYROMITRA SCORECARD

- 1-Cap margin remote from the stalk; stalk base often has a reddish stain.....*G. californica*
- 1-Cap margin touching the stalk; stalk base never has a reddish stain.....2
- 2-Stalk interior contains dirt; stalk interior has many compressed chambers.....3
- 2-Stalk interior is clean; stalk interior has one open chamber (sometimes several).....4
- 3-Stalk almost as broad as the cap.....*G. gigas*
- 3-Stalk half as broad as the cap.....*G. korfii*
- 4-Cap appears to be inflated.....*G. esculenta*
- 4-Cap folded like an unfortunate fortune cookie.....5
- 5-Ascospores 22-28 μm long with obscurely narrow ends; mushroom grows on soil.....*G. ambigua*
- 5-Ascospores 16-22 μm long with rounded ends; mushroom grows on wood or humus.....*G. infula*

Some *Helvella* species will fit this key. Use a reliable field guide to confirm your identification.

Volunteer to host a field trip. Call Andy, 523-5975.

Do send overdue dues to Margaret Holzbauer, 703 So. Cloverdale, Seattle, WA 98108 (\$6.00/\$8.50/\$12.00).

THE JOY OF DUNG

Paul Kroeger

[*Mycophile*, Vancouver (B.C.) Mycological Society]

It's brown and sounds like a bell. If you poke it with a stick it smells. Every creature known on earth produces some of it, though some maintain that Queen Victoria never did. Anyone who has spent some time around, or perhaps more accurately behind, large farm animals such as cattle and horses knows that a prodigious amount of fecal matter can be generated in a fairly short time. Material which must be broken down in a short time if we're not to be up to our ears in it. Although a large portion is broken down initially by fly larvae and earthworms, it is fungi that play the greatest role in degrading richly nitrogenous dung to the consistency of soil.

While most of the coprophilous, or dung-loving, fungi are microscopic, there are also many species of mushrooms found exclusively on dung. The majority of these are found on droppings of large herbivores while few, if any, are found on carnivore droppings. The reason for this lies with the composition of the material as dictated by the diet of the animal. Plant cells differ from animal cells, each plant cell being enclosed in a rigid wall of cellulose. While animal cells have no such protective shell and are easily digested, plant cells resist the digestive juices of most animals. For this reason herbivores often have flat grinding teeth that crush the cell walls and some have extra stomachs, or rumens, where vast numbers of cellulose-digesting bacteria work on the plant tissue. Even in the ruminants much cellulose is excreted. By contrast, feces of carnivores, and of man, are mostly composed of bacteria--living, dead, and partly digested. These do not host mushrooms or many other macro-fungi.

Herbivore dung contains much undigested plant tissue. The ruminants such as cattle and sheep have fairly efficient digestion while a non-ruminant such as the horse excretes much more unaltered plant tissue. The dung also carries with it a large number of whatever bacteria live in the gut of the animal. Differences in the composition, number, and kind of bacteria present in dung determine the species of fungi that will eventually colonize it. In many cases dung fungi are found only on certain kinds of dung. For example, *Panaeolus semiovatus* is usually only on horse dung, *Psilocybe angustispora* grows on elk and marmot dung, *Coprinus radiatus* is found on fresh horse dung, and *Panaeolus africanus* is said to grow only on hippopotamus dung. It is therefore important to note what kind of dung a mushroom is growing on.

On occasion it is hard to be certain that one has a dung mushroom. For example, not long ago a woman brought what appeared to be a lump of dung with some tiny mushrooms sprouting out of it. On close examination it proved to be an owl pellet (a ball of feathers, bones, and other undigestible bits of bird regurgitated by an owl) on which was growing *Onygena corvina*, a fungus that grows on rotting feathers.

Coprophilous mushrooms have set preferences not only to the type of dung but also to the degree of degradation of the dung. As dung ages new fungi grow and the old ones vanish, and the dung looks less and less like dung and more like soil. This succession from species to species can easily be observed by setting up a "fungarium," or enclosed fungus garden. This is accomplished by collecting dung from the wild and setting it in a covered container that allows for easy viewing while retaining moisture. For large material, fish tanks or glass ovenware works admirably while small pellets like those of rabbit do

well in petri dishes. The dung should be placed on paper or other absorbent material which is kept moist. I've had some success with just "planting" dung in moist soil in flower pots. The fungarium should be kept in a well lighted place and given occasional access to fresh air. Sometimes insects will be a problem; light spraying with Raid or similar insecticide will control them.

Coprophilous mushrooms are excellent study material for the novice mushroom hunter. A limited number of genera grow on dung; learning to distinguish between them is a good stepping stone to distinguishing between the vastly greater variety found in diverse habitats. Learning to separate the common species within some of these genera can hone one's power of observation to the extreme; while some are very distinct others require subtle observation.

Spring and early summer are fine times to go dung searching. A balmy spring day spent browsing among the cattle can be a great tonic. And exciting, for there is always, lurking amongst the predictable inhabitants, a surprise, a misfit, something new and different. Let me assure you, there be many surprises among the dung fungi.

PREPARING MUSHROOMS

Helen Lashway

I've been eating wild fungi ever since a neighbor took pity on me and showed me how to find the elusive *Verpa bohemica*. I cut them in half and removed and opened the caps so I could wash out the bugs (if any) under cold, running water. Then I drained them on kitchen towels. Then I rolled them in stone ground 100% whole wheat flour and cooked them in oil or lard until they were brown and crisp (butter or margarine works equally well).

I have since discovered other mushrooms and other methods of preparation, but this remains my favorite, with tempura being second. One advantage of the brown-flour method is that it works well for nearly every sort of fungus -- especially for ones like wood blewits that make you wonder if you really want to make a meal of a purple fungus. By the time they are nicely browned and crisp, you forget all about purple. In fact, I have never found anyone who did not like them prepared in this manner, if they could be persuaded to take a bite.

This also works with people who do not like other mushrooms. Late last May, for example, we went hunting black morels with John and Ginger Jeromchek up on the jeep trails out of Ellensburg. We found lots of morels, along with lots of yellow coral and a few puffballs. The coral was not quite out of the ground and not yet opened up, making it easy to clean; the flesh was thick and in texture much like *Boletus edulis*. We cooked the corals and puffballs right along with the morels, and everyone we shared them with pronounced them delicious! The only drawback to this is, of course, that those who did not like them (therefore leaving more for you) suddenly do, and there you are!

New phone numbers:

Ann F. Barr	365-8849
Jan Foster	283-8094
Walter and Lori Knox	789-8156
Blanche Peters	378-2722
Joanne Sebring	868-8910
Joy and Roger Spurr (after March 16)	392-6768