Speaker for January 16 MSSF Meeting

Gary H. Lincoff

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Deadline for the February 2007 issue of *Mycena News* is January 10.
Please send your articles, calendar items and other information to:
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Mycena News

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MycoDigest: Fruits of the Forest

Else C. Vellinga

When and where mushrooms fruit is one big mystery. Water and temperature are the main factors, but we do not have a formula to tell us when the boletes will show up at Salt Point. So many days after the first rain, a daily high temperature of x and a low of y, and then they should be popping up. No, it doesn't work like that.

However, there is a small group of mushrooms that requires some other trigger than just moisture and the right temperature. Some will only fruit when ammonia is available. This can be in the form of a carcass, an animal latrine, or an old wasp nest. In an experimental plot at Salt Point State Park where urea was added to the soil, *Tephrocybe tylicolor*, a small greyish mushroom, responded immediately and its fruit-bodies appeared. This species normally grows on places where cows have peed, around carcasses, and on dung; but here it only grew on the plots treated with urea. The more urea, the better it did. Such mushrooms are called ammonia fungi, as they only form fruit-bodies where ammonia and similar chemicals are available in great quantities.

Tephrocybe is a saprotrophic species, but there are also ectomycorrhizal fungi that only fruit in the presence of ammonia. *Hebeloma radicosoides* from Japan is a striking example. Fruiting of such a species is rare, as there has to be both the host tree and the right amount of ammonia in the same place. It is a big, showy, yellow species, with a long "rooting" stipe and a fringed ring. Whereas most *Hebeloma* species have very well defined smells, such as earthy beet leaves, cacao, or orange blossom, *H. radicosoides* lacks any particular smell.

The *Hebeloma* species have been found on a wide range of strange habitats. They have been reported at the latrine area of a Boy Scout camp, a deserted wasp nest, and on raccoon dog excrement. They like a wide range of chemicals, such as urea, milk casein, arginine, and sodium glutamate.

Hebeloma radicosoides is so far only known in Japan, but its look-alike, *H. radicosum*, is widespread and known in Japan, Europe, and North America. Again, there is a rooting fruit-body connected to an animal midden, but it is inhibited by ammonia. This species has been found mainly on the abandoned latrines of moles. These latrines are in the ground, and there the fungus has its connection with the tree. The soil is full of fine roots with mycorrhizal tips and fungal mycelium. In more northern regions where moles do not occur, e.g. in Scandinavia, wood mouse middens (*Apodemus*) are an alternative.

Similarly, in a beech forest in Switzerland, the mushroom was found growing out of a wood mouse nest. Just like moles, the wood mice have their nests deep in the ground. The mushrooms start at the level of these nests and surface one to two feet above them. In other words, it is what we call a deep rooting species; but of

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MycoDigest is a section of the Mycena News dedicated to the scientific reiew of recent mycological information.

MicoDigest: Fruits

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course, it starts at the bottom and grows upwards, not like a plant, which sends its roots down.

These two *Hebeloma* species have been thoroughly investigated by a Japanese mycologist who traveled all over the world in pursuit of these mushrooms.

The two substrate types on which the mushrooms grow seem very similar—urea treatments (including carcasses and raw excrements) versus abandoned middens of moles and wood mice—but apparently there is a difference in the chemicals the fungus can absorb and use. Different fungal species, or even different strains of the same species, use a different form of nitrogen. Some species, such as *H. radicosoides*, are only able to use ammonia and its derivates; others will only thrive on nitrates. Another group of ectomycorrhizal fungi uses peptides or proteins as its sole nitrogen source. So here again, as in many other aspects of fungal life, much is possible.

In Europe, *Hebeloma radicosum* associates with deciduous trees (beech, etc.), which may be the reason that it does not occur in our area; but the wide array of burrowing little rodents here might invite other species. Perhaps we have not yet recognized the connection.

Further reading:

Kaneko, A. & N. Sagara, 2002. *Responses of* Hebeloma radicosum *fruit-bodies to light and gravity: negatively gravitropic and nonphototropic growth*. Mycoscience 43: 7-13.

Sagara, N., 1995. *Association of ectomycorrhizal fungi with decomposed animal wastes in forest habitats: a cleaning symbiosis?* Canadian Journal of Botany 73 (Supplement 1): S1423-S1433.

Sagaro, N., B. Senn-Irlet & P. Marstad, 2006. *Establishment of the case of* Hebeloma radicosum *growth on the latrine of the wood mouse*. Mycoscience 47: 263-268.

Sagara, N., T. Hongo, Y. Murakami, T. Hashimoto, H. Nagamasu, T. Fuiharu & Y. Asakawa, 2000. Hebeloma radicosoides *sp. Nov., an agaric belonging to the chemoecological group ammonia fungi*. Mycological Research 104: 1017-1024.

Yamanaka, T., 2001. *Fruit-body production and mycelial growth of* Tephrocybe tesquorum *in urea-treated forest soil*. Mycoscience 42: 333-338.

Marin Mushroom Mania

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Mushroom Forays in the MAGC Gardens – MSSF and MAGC leaders will take small groups for walks around the grounds to discover both natural and cultivated fungi.

Mushroom Displays and Identification: Browse the mushroom displays and bring your collections to be identified by MSSF experts.

Mushroom cultivation and composting demonstrations: MSSF Cultivation Chairperson and Randall Museum Head Gardener Ken Litchfield will conduct hands-on demonstrations of mushroom straw cultivation, log plugging and composting techniques. Don't miss this exciting opportunity to learn about growing your own mushrooms at home!

Cultivation Corner

Ken Litchfield

The rainy season has finally infused the ground and soaked the duff around the oak woodlands. The moss is green and soft and fluffy, the lichens are unfurled and foliated, and the mushrooms are emerging. Before all the latest gushes of rain *Pleurotus* oysters had already been shelving, and the *Hericeum* Crabalones were creeping out the hollows in logs and from trunks of oaks. Both of these earlies are good for seafood chowder. Simmer some shredded shrimp or fish in butter until the flesh turns white all the way through, and add chopped oyster mushrooms and crabalones till their juices have come out and they have softened. Then add cream and seasoning to finish it out. The gilly chopped oysters have the texture of fish or crabmeat, as does the shaggy part of the crabalone, while the denser base of the crabalone is reminiscent of the real abalone. These mushrooms are perfect for stretching and supplementing your wild caught abalone. It's the season for both.

The densest part of the bases of fresh oysters and crabalones can be pulled from the log, or cut from the mushroom, and added to fresh, damp, hardwood chips. Leapoff is easier if the temperature is cool and the air humid. Older oysters and crabalones past prime for eating can be crushed up in water to make a spore/mycelium slurry to pour into cracks and hollows in hardwood logs and stumps that you can visit in the future.

While you're looking around the oaks you may find some manzanita and there look for manzanita boletes, *Leccinum manzanitae*. They're beautiful, rustic-looking mushrooms. The tops are as rusty-maroon as the trunks of the manzanita itself, on top of tannish-white stalks with little black shags on their sides. When you see a big one up against the base of a large, gnarly maroon manzanita trunk, splattered with spidery blue-green foliose lichens, it's almost aesthetic overload. They are great cooked fresh, and, sliced and dried, they rival any other Bolete in rich aroma. Any of these mycorrhizal mushrooms that are past their prime for eating can be spore-slurried and used to inoculate around the bases of any nonfruiting manzanitas.

It's just getting to be the season of the pretty purple, copper, golden triumvirate of blewits, candy caps, and chanterelles under oaks. Where you find one, look for the others. The blewits are saprophytic while the candy caps and chanterelles are mycorrhizal on the same oaks.

But watch out! Those pesky death caps grow along with the triumvirate of blewits, candy caps, and chanterelles. It's pretty easy to tell the difference, however, even for the most timid, fear-filled novice. Death caps are pure white all over with a white veil and volva that may not be hanging around and the top of the cap is typically the classic olive green, *but* could be "variable." And they're quite tasty, too. And you can *taste* them safely. That won't hurt you; just **don't** swallow. A little piece the

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