THE CASE OF THE SNEAKY MUSHROOM

Many visitors to Algonquin Park these days are enjoying wild mushrooms as food. The flavors can be subtle and excellent and, provided the collector can positively identify any species eaten, it is an activity we whole-heartedly encourage.

We personally have been very keen on wild fungi ever since friends served us steak with pearly white oyster mushrooms many years ago. Although we have learned to identify and prepare many other kinds since then, the memory of that first meal remains vivid and the oyster mushroom remains one of our favorites. In some ways, we see it as the model edible wild mushroom — good tasting, easy to identify, and abundant.

Still, as far as the basic biology of the oyster (and other) mushrooms was concerned, we naively thought all those years that we had a pretty good picture of how things worked. The structure we ate was just the reproductive part or "fruit" of the mushroom plant — in the same sense that a blueberry is the reproductive part of a blueberry plant. The only difference, really, was that you can easily see the non-berry part of a blueberry plant, whereas with a mushroom the non-reproductive part is much less visible. For one thing, it consists of very tiny thread-like structures called hyphae (singular hypha) and secondly, the hyphae are out of sight in dead leaves on the forest floor or inside dead wood.

The visible, reproductive part of a mushroom doesn't contain seeds the way a blueberry does, but instead produces millions of microscopic spores each capable of starting a new mushroom plant. The spores float through the air and although the chances are slight some of them happen to land on surfaces suitable for the particular species of mushroom in question. In the case of an oyster mushroom spore, this is the exposed, dead wood of a hardwood tree like sugar maple.

The spore gives rise to a hypha that grows into the wood, branching again and again until it forms an enormously complicated network of threads that digest the wood and break it down (rot it, in other words) into simpler chemicals. When conditions are warm and moist enough and if the thread network is healthy enough, some of the threads will come together and produce one or more of the visible, spore-producing structures we call mushrooms.

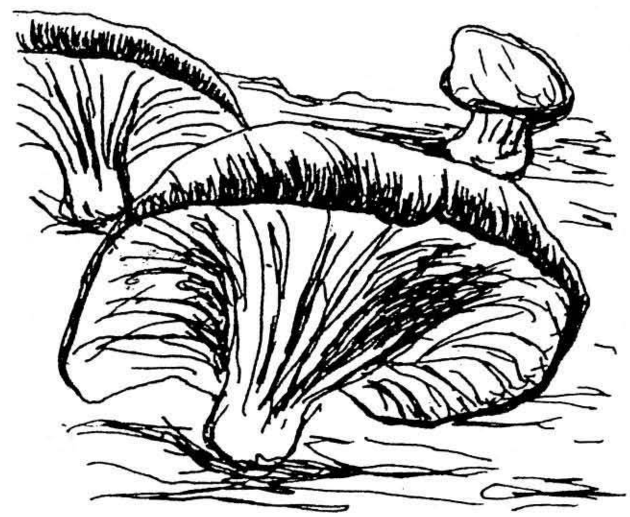
These were the basics — or so we thought — of an oyster mushroom's life and it all seemed quite simple. With the benefit of hindsight we might have suspected that reality would be a bit more complicated.

At first glance, the hyphae of an oyster mushroom would seem to be in an especially favorable spot. There is a lot of energy locked up in the cellulose (food) surrounding an oyster mushroom growing inside a dead tree. To actually use this food, however, the mushroom must break the cellulose down and this requires the action of enzymes. Enzymes are proteins and all proteins contain nitrogen. The problem for an oyster mushroom is that dead wood contains very little of this vital commodity. And, unless the oyster mushroom can get past this problem, it will be unable to manufacture the enzymes and other proteins it needs to feast on the bountiful supply of cellulose all around it.

To make matters worse, the oyster mushroom has to compete with bacteria, some of which can take nitrogen right out of the air and make their needed proteins that way. The oyster mushroom, unable to perform this difficult chemical trick, might seem to be left at the starting gate in the race to exploit the rich bounty (i.e. dead wood) left when an old tree dies.

Old Algonquin hands will recognize that this situation is quite similar to that found in bogs — which are also notoriously poor in nitrogen. The fact that several bog plants (sundews and pitcher-plants, for example) get around the problem by trapping protein (nitrogen) -rich insects suggests a possible solution for the oyster mushroom as well.

To be sure, insects are far too big and powerful to be captured by mushroom hyphae but other, more suitable-sized nitrogen sources are available. The woody environment of the oyster mushroom is shared by tiny worms (less than one millimetre long) called nematodes. They make a living by preying on the bacteria which digest the same wood attacked by the oyster mushroom. Because they have fed on the nitrogen-rich bacteria, the nematodes are themselves a rich source of nitrogen.



In hindsight it makes excellent sense that mushrooms would be able to tap this source of nitrogen but, until 1983, no-one realized that they actually do. The oyster mushroom and 10 other species of wood-rotting fungi have now been shown to be carnivorous nematode eaters and thus to have solved their nitrogen deficiency problem. Whenever a nematode approaches an oyster mushroom hypha too closely it is stunned by a chemical given off by the mushroom. Over the next hour new threads from the mushroom converge on the immobilized (but still living) nematode, enter its mouth, grow through the nematode's body and digest it from the inside out. Within 24 hours the drama is over and the oyster mushroom is making new proteins of its own from those taken from the nematode.