Devil's Urn at the stage where ascospores are released from the inner layer of the urn-like structure. With age, the fruiting bodies often turn black. Often a huge number of ascospores can be released at one time giving the appearance of a puff of smoke. Photo by Colin Peters.

Cauldrons and Urns of Witches and Devils

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Foraying for mushrooms is a complete sensory experience—vibrant colors of fruiting bodies, the earthy smell of soil when you pluck a mushroom from the ground, aromas that range from the pleasant *Hydnellum suaveolens* to the disagreeable mothball smell of *Tricholoma odorum*. And of course tastes that range from the peppery, tongue-numbing effects of a *Russula* to the delightful sweetness of *Lactarius* Candy Caps.

Some with mysterious names can give you goosebumps such as Dead Man's Fingers (*Xylaria polymorpha*), Dead Man's Toes (*Ganoderma* sp.), Ghost Mushrooms and Jack-O'lanterns (*Omphalotus* spp.), and Witches' Butter (*Tremella* sp.).

While these fungi are relatively common and well known, there are other fungi more enigmatic also with mystical names to match their unusual morphology including the early spring fruiting Witches' Cauldron (*Sarcosoma globosum*) and Devil's Urn (*Urnula craterium*).

A Bewitching Encounter: The Witches' Cauldron Fungus

The Witches' Cauldron (*Sarcosoma globosum*) is a very unusual cup fungus in the Ascomycota that is named for the bulbous shape of its fruiting body and for the unique ability of its hymenium to become more concave as it ages. This allows for water to collect in it. There are few publications about this fungus but a Swedish paper by Josefine Kyhlström Blomqvist indicates the concave hymenium is vital for its reproduction, facilitating the liberation and spread of ascospores from asci housed in the hymenium when it encounters water. When there is a surplus of water, it pools on the hymenium. This with the gelatinous bulbous base creates a cauldron-like appearance. The water also acts as a reservoir used to hydrate the jelly-like substance inside of the fruiting body. Despite this unique structure, the fungus has a short lifespan and is found only in early spring. First sightings of this fungus usually coincide with the melting of snow, which varies from year to year, depending on the winter.

Wondering what is inside the base of the cauldron, we sectioned one and mounted it for microscopic observations.

Article author Nick Rajtar observing a cluster of several Witches' Cauldrons in a Minnesota old growth spruce stand.

Along with a gooey clear substance, it was filled with a jumble of serpentine mycelium. These snake-like hyphae appear ideally suited to fill a fungal witches' caldron.

What makes the Witches' Cauldron even more extraordinary is its extreme rarity. It is a seldom seen wonder, preferring specific habitats. There are very few locations where this species has been found in North America. In Minnesota, we have found them in old growth spruce stands that have a sphagnum moss understory. These types of locations have become increasingly

The Witches' Cauldrons (*Sarcosoma globosum*) has a thick cuplike structure for a fruiting body that fills with water after rainfall.

rare due to logging and the loss of old growth forests.

In Europe, *Sarcosoma globosum* has been found very infrequently in Finland, Estonia, Norway, Poland, and Sweden. Professor Anders Dahlberg from the Swedish University of Agricultural Science in Uppsala has surveyed and studied this fungus and provided information to us on its status and ecology in Sweden. It is commonly called *bombmurkla* or "Bomb Morel." Reports dating way back to the 1700s state that the grandchildren of Elias Fries threw the fungus at each other as a game. According to Professor Dahlberg, although more people in recent years have been looking for this fungus, the species has not increased in occurrence over the last few decades and may have even decreased. This is apparently due to deteriorating and disappearing habitat for the fungus to grow.

Currently, there is no conservation status for this fungus in the United States. Canada has recently added *Sarcosoma globosum* to a list of macrofungi that should be considered for a formal conservation assessment. In Europe, the fungus is considered near threatened and has been on the IUCN Red List of Threatened Species in 12 countries since 2015. In Sweden it is one of five formally protected fungal species in that country.

The primary threats to this fungus include residential and housing development, deforestation/timber harvesting, and climate change. When areas are logged, the fungus will disappear from that site. Climate change also appears to play a role in the reduction of suitable habitat for the fungus. Dry springs and melting snow are required for the Witches' Cauldron to grow. The fungus does not grow in overly moist, hot or humid locations, which is why it is only found in the Northern Hemisphere. Climate change is causing winters to become milder and the presence of more rain and less snow could severely impact where the fungus grows and likely will shrink its habitat. Another factor related to climate change that has reduced old growth spruce habitat in Europe is the spruce bark beetle *Ips typographus*. Professor Dahlberg and researcher Louis Mielke indicate that recent bark beetle outbreaks resulting from dry weather conditions and tree stress have been particularly detrimental to forests and subsequent fruiting of the Witches' Cauldron.

While it is not known for its culinary value, it has occasionally been consumed but has not been considered a good edible. There is, however, a pastry that

Two Witches' Cauldrons growing out of the duff in a spruce forest. Reflections in the cauldron often give an eerie appearance.

is made to resemble the fungus that has been sold in one patisserie for over 25 years. Additionally, in parts of Eastern Europe, the cauldron jelly is used to rejuvenate and moisturize skin. It also has been used in folk medicine, particularly in Western Siberia. Here in North America, according to iNaturalist, observations from 2010–2024, the fungus has been reported in only two states, Minnesota and New York, but found in six Canadian Providences: New Brunswick, Quebec, Ontario, Manitoba, Alberta, and British Columbia.

Living in Minnesota, we have had the opportunity to observe and study this fungus for the past four years and plan to continue our research for several more years. We have seen firsthand what harvesting can do. One of the spruce stands where we found this fungus fruiting over the course of several years was recently harvested and it appears the habitat has been altered severely which has impacted fruiting. Having a defined conservation status for this fungus in the United States should help to protect sites and habitat where the fungus is found. In Sweden, it was designated as vulnerable, but this just means the fungus cannot be picked and it does not provide protection from forest cutting practices.

If you see the Witches' Cauldron in your state, especially in the states where it hasn't been observed, we encourage you to document it in iNaturalist. With more people out looking for this fungus in early spring, more locations could be found. This happened in Finland and Canada, where a greater number of observations were reported after people became aware of this fungus and ventured out to spruce bogs to look for it.

The Mysterious Devil's Urn Fungus

The Devil's Urn fungus, *Urnula craterium*, was first described in the early 1800s. Exactly when it received the common folk name of Devil's Urn is difficult to determine but it is another example of an odd-looking fruiting body conjuring up mysticism.

The Devil's Urn is brown to black and produces rather large urn-shaped structures that can be found growing on dead oak stems and limbs that have fallen onto the ground. If found before the spherical bodies open, they can resemble fat Dead Man's Fingers (*Xylaria polymorpha*). The coloration seems to be related to their age and environmental conditions with the brown fruiting bodies gradually turning grey and black. Once the urn (apothecium) opens, the inner lining produces asci and ascospores. Similar to the Witches' Cauldron, it fruits in early spring and is often seen just after snow melt. The urn-like structures have serrated margins that often split and crack with age. The fruiting bodies are usually found in clusters and are always on wood. If the wood is buried in leaf litter, the fungus produces a stem and the urn forms at the surface of the duff.

Like many other cup fungi, it can send a puff of spores up into the air. The release of these ascospores occurs when there is a change in the environment. For example, if you gently blow your warm breath over the top of them, it is followed by a puff of what appears to be smoke. This is actually hundreds or even thousands of ascospores being

shot out all at once. A video of this was taken by forest pathology and mycology graduate student Colin Peters and can be seen on YouTube at https://youtu.be/P840j98mD8o.

The Devil's Urn can be frequently found In Minnesota's oak forests as well as in hardwood forests over a large part of northern North America. Although few people would ever consider eating anything associated with a Devil's Urn, they do not appear to be poisonous. We have never considered eating them but more adventurous people, such as Colin Peters, have done so and he indicates they have a slightly tangy flavor.

The Double Life of the Devil's Urn

A mysterious aspect of the *Urnula* fungus is that it lives a double life. Since the early 1900s, a canker disease of oak trees, American chestnut and some other hardwoods has been attributed to a fungus that produces an asexual state called *Strumella coryneoidea* (which is now called *Conoplea globosa*).

This pathogen enters the stems of trees through wounds and attacks the phloem and cambium. It causes a perennial canker that kills stem tissue year after year producing an elongate and somewhat target-shaped canker. Cushion-like structures that form by the fungus on the older areas of the cankers only produce asexual spores. Studies completed long ago found that these spores do not germinate, and likely may be acting as spermatia to aid in fertilization of opposite mating types that will ultimately produce a sexual stage. If the spores do not germinate, it is a mystery how the fungus causes infection and what the fruiting of the sexual stage would be. These questions have remained unanswered for some time, but we now know that the fungus causing *Strumella* canker and *Urnula* fruiting bodies are the same.

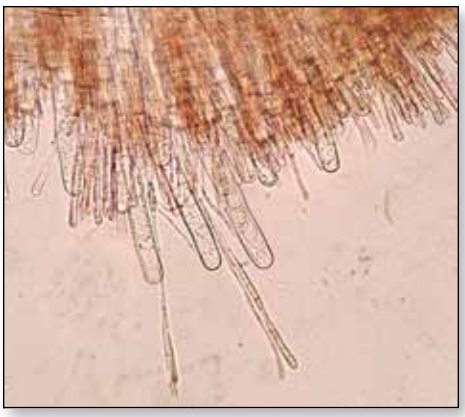
Since *Urnula craterium* occurs so commonly in oak forests where *Strumella* canker is located, it was suggested that this may be the sexual state. Trials followed, inoculating *Urnula* into oaks and these inoculations produced cankers.

We have always thought it very strange for a fungus with such a large fruiting body living saprotrophically on

The cauldron consists of a jelly-like bulbous base with a top layer that produces asci and ascospores.

dead stems would be able to produce spores that infect living trees and be pathogenic. There is a lot that still needs to be learned about the life cycle of this fungus and if colonization of live trees is needed for the fruiting bodies to be produced once the infected branch or limb breaks off and falls to the ground. There are other Ascomycota that produce apothecia, but they produce very small fruiting bodies right on the cankered stem such as *Encoelia pruinosa* on aspen, *Lachnellula willkommii* on larch, and *Atopellis piniphila* on pines.

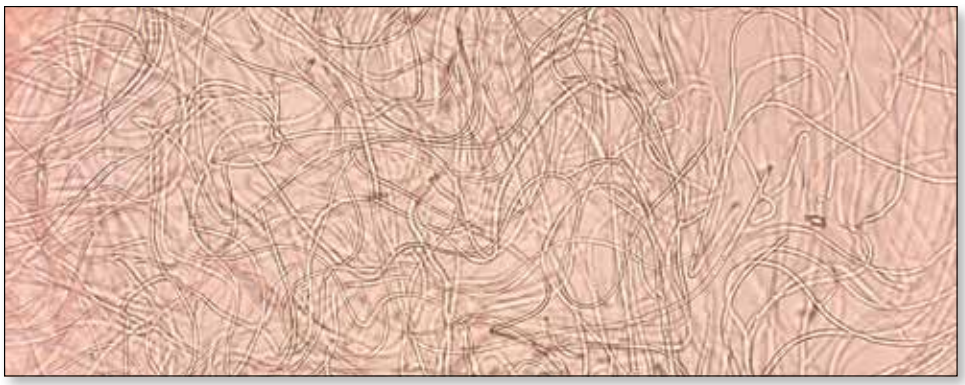
In Sweden, many people admire the Witches' Cauldrons or *bombmurkla* (which means "Bomb Morel") and a pastry is made that resembles the fungus. Photo courtesy of Anders Dahlberg.



Mature asci and ascospores of the fungus can be found in the top layer of the cauldron. Water filling the cauldron from rain helps keep the lower cauldron filled and apparently aids in ascospore dispersal. Sac-like structures (asci) each contain 8 ascospores.

Urnula can be pathogenic and cause large perennial cankers on oak trees. The fungus never produces its black urns on live trees. Instead, they are produced only on dead infected oak stems and limbs after they have fallen to the ground.

Urnula is unusual and we think it rightly deserves its demonic folk name having the vicious ability to kill trees and spend a large part of its life cycle away from the killing activity disguised as a saprophyte.



Jumbles of serpentine hyphae can be found inside the Witches' Cauldrons when a section of the gelatinous part of the cauldron is observed with a microscope.

The Devil's Urn, *Urnula craterium*, in an early stage of growth showing the orb just beginning to open. Photo courtesy of Taylor Lockwood.

A group of mature Devil's Urn apothecia growing up from oak wood buried under leaf litter. Photo courtesy of Taylor Lockwood.

Acknowledgments

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