The Fungal Life Aquatic: Freshwater Observations

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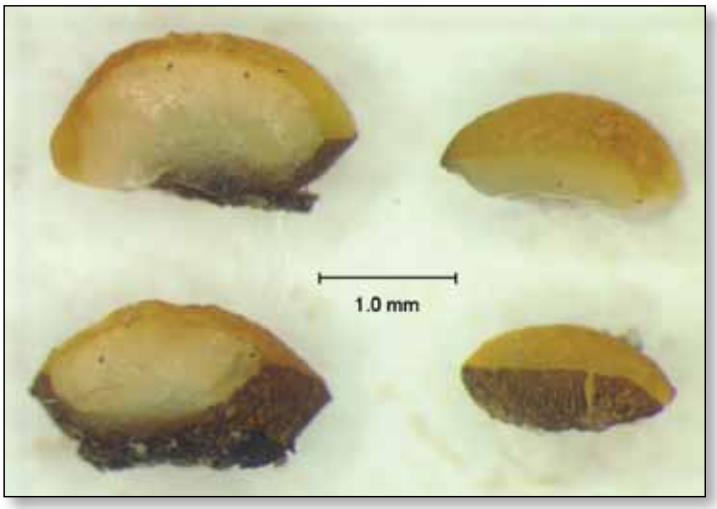
As more and more habitats are explored, our understanding of fungi continues to expand. One habitat in particular has steadily grown in known macrofungal richness. And while macrofungal diversity in aquatic habitats remains limited, there are now more than a handful of fungal species known to grow and fruit underwater, and several more that can withstand temporary and even sustained inundation.

Aquatic habitats are targeted by some surveys as several aquatic fungi are on sensitive, threatened and endangered species lists. In addition to the rare gilled basidiomycete, *Psathyrella aquatica*, the following aquatic Ascomycota grow in freshwater streams of the Pacific Northwest (PNW) and around the world. My experience is mostly limited to Oregon, Washington, and California; so while I expect to hear of exciting future observations from around the globe, the following pertain to occurrences in the PNW.

The most delightful, in my aesthetic opinion, is the bright yellow orange-red "aquatic matchstick," *Vibrissea truncorum*. Up close, this flashy yet diminutive underwater stalked Leotialian wonder clings to sticks often in loose rows. Its convex orange cap bears long threadlike spores that appear as a cottony white

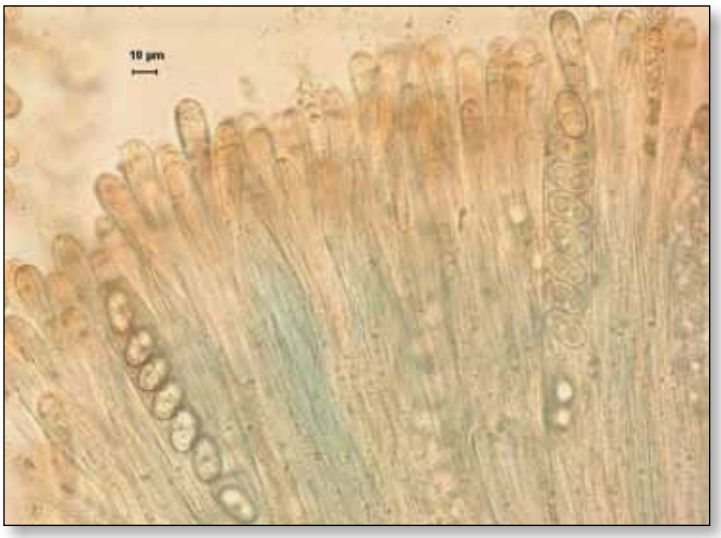


Vibrissea filispora up close.

Vibrissea filispora.

Vibrissea truncorum up close.

Vibrissea truncorum.



Adelphella babingtonii egg-shaped spores.

Adelphella babingtonii.

fuzz on the hymenial surface as the ascocarp dries and the spores are ejected from collections removed from water. Its spores are distinctive and a closely related, but sessile species that also grows underwater, looks similar minus the stalk, is named for these threadlike spores: *V. filisporia*.

The most common underwater macrofungus encountered in the central Oregon Cascade freshwater streams is another leotialean Ascomycte: *Cudoniella clavus*. A widespread and morphologically variable species, *C. clavus* may appear elongated with a convex "cap" resembling a drab *V. truncorum*, or stout with a concave "cap" resembling an underwater stalked cup. When macromorphology confuses the collector, its elliptical spores distinguish it easily from *V. truncorum*, and its non-amyloid asci distinguish it from any *Peziza*.

Another sessile macrofungus that grows on submerged woody debris is the easily overlooked brown pezizalean *Adelphella babingtonii*, clinging to wet sticks often near the smaller, brightly colored *V. filisporia*. *Adelphella babingtonii* has smooth egg-shaped biguttulate spores.

One ascomycete was encountered that was not on survey lists and was, in fact, an undescribed stalked cup species in the genus *Peziza*. Collecting undescribed species poses an ongoing

Cudoniella clavus up close.

Cudoniella clavus elliptical spores.

predicament for environmental surveys. This species was recently described as *Peziza oliviae*, an olive-brown goblet nestled among colorful cobble in mountain streams on submerged sticks and small woody debris. It has distinctive amyloid asci that place it firmly in the genus *Peziza*.

Also encountered near streams, and in or near standing water, are the flashy, "swamp beacon," *Mitrula elegans* and the equally elegant, *Sclerotinia sulcata*. An occasional underwater dweller, also worth noting because it has been observed submerged several times in streams at low flow, is the striking "eyelash cup," *Scutellinia scutellata*.

One report of an underwater gilled mushroom that I investigated in southern Oregon turned out to be a *Hebeloma* sp., however it appeared in a location that was only temporarily inundated. This is an example of how some fungi can withstand submersion due to floods, often near the shore or in puddles but, these are not considered to be aquatic fungi. Citizen Scientists who are including aquatic habitats in their fungal surveys, should

Cudoniella clavus.

Sclerotinia sulcata asci.

Sclerotinia sulcata.

Peziza oliviae.

be aware of the basic hydrological patterns of the area. Obviously stream banks below dams are subject to temporary inundations, and after heavy rain events many mushrooms are stranded below water and may persist for weeks.

Keep your eyes open! Certainly there are more underwater macrofungi to be discovered and reported. As Citizen Scientists are more and more able to make significant contributions to mycology by collaborating with research scientists, or even by sending collections off for sequencing and directly depositing molecular data into GenBank, as well as posting morphological observations to sites like Mushroom Observer

Peziza oliviae.

(mushroomobserver.org)." It is possible that individuals anywhere can find and document something truly amazing. Additionally, especially in the hot summer months, it's nothing short of wonderful to scamper along stream banks and wade through cool waters. So don't just gander at the soil, look beneath the water too.

Underwater fungi are generally saprotrophic and contribute to the community of organisms that break down organic matter deposited in waterways. Since they cannot release their spores into the atmosphere for dispersal, they likely require animal vectors like aquatic invertebrates and possibly vertebrates as well to spread their spores.

*This paper was adapted from "*The (Fungal) Life Aquatic*" presentations given at Breitenbush in October 2013 and Sonoma County Mycological Association SOMA Winter Mushroom Camp January 2014.*