Diverse fungi secrete similar suite of decomposition enzymes

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Found in leaves and wood, the yellow-orange Ascomycetes species secretes molecules, like the one represented. Researchers compared fungal secretions to enhance understanding of the species' role in soil biogeochemistry and climate dynamics. Credit: US Department of Energy

Soil fungi secrete a wide range of enzymes that play an important role in biofuel production and bioremediation of metal-contaminated soils and water. A recent study reveals different fungal species secrete a rich set of enzymes that share similar functions, despite species-specific

differences in the amino acid sequences of these enzymes.

The study enhances understanding of the role fungi play in processes occurring in soil. The study could be used to engineer fungal enzymes for biofuel production and bioremediation efforts.

Fungi secrete a diverse repertoire of enzymes that break down tenacious plant material. These powerful enzymes degrade plant cell wall components such as cellulose and lignin, resulting in the release of carbon dioxide from soils containing dead plant material into the atmosphere. As such, fungal enzymes are not only critical drivers of climate dynamics, but they also hold promise for cost-effective development of alternative transportation fuels from biomass. Moreover, the manganese [Mn(II)]-oxidizing capacity of certain fungal species can be harnessed to remove toxic metals from contaminated soils and water. Yet few studies have characterized enzymes secreted by diverse Mn(II)-oxidizing fungi that are commonly found in the environment. Recently, a team of researchers used liquid chromatography-tandem mass spectrometry (LC-MS/MS), genomic analyses, and bioinformatic analyses to characterize and compare enzymes secreted by four Mn(II)-oxidizing Ascomycetes species. These four species were isolated from coal mine drainage treatment systems and a freshwater lake contaminated with high concentrations of metals and are associated with varied environments and common in soil ecosystems worldwide.

The researchers performed LC-MS/MS-based comparative proteomics using the Linear Ion Trap Quadrupole Orbitrap Velos mass spectrometer at the Environmental Molecular Sciences Laboratory (EMSL), a Department of Energy's (DOE) Office of Science user facility. This analysis revealed that fungi secrete a rich yet functionally similar suite of enzymes, despite species-specific differences in the amino acid sequences of these enzymes. These findings enhance understanding of the role Ascomycetes species play in biogeochemistry and climate

dynamics and reveal lignocellulose-degrading enzymes that could be engineered for renewable energy production or bioremediation of metal-contaminated waters.

This study represents a collaboration among scientists from Harvard University, EMSL, Pacific Northwest National Laboratory, Smithsonian Institution, DOE Joint Genome Institute (JGI), Centre National de la Recherche Scientifique and Aix-Marseille Université, King Abdulaziz University, University of Minnesota, and Woods Hole Oceanographic Institution.

More information: Carolyn A. Zeiner et al. Comparative Analysis of Secretome Profiles of Manganese(II)-Oxidizing Ascomycete Fungi, *PLOS ONE* (2016). DOI: 10.1371/journal.pone.0157844