

## Connecting genomic signatures, nutritional strategies and function in mushroom forming fungi

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Mushroom forming fungi play tremendous role in terrestrial carbon cycling through the decomposition activity of white rot and brown rot wood decomposers and litter decomposers. Extensive genome sequencing of white and brown rot fungi has shown that the appearance of white rot and the multiple transitions from white to brown rot have left signatures on the genomes those fungi. At the same time the same studies have shown that some wood decayers in mushroom forming fungi do not belong in any category suggesting hidden functional diversity among wood decomposers. In contrast litter decomposers remain a functional black box. We sequenced the genomes of seven litter decomposers in Agaricales and compared their plant cell wall decomposition machinery with that of other white and brown rot fungi. Furthermore we used Raman spectroscopy to examine cellulose degradation across the three groups. Both the genomic and Raman results suggest that litter decomposers share with white rot fungi the enzymatic decomposition of cellulose, while brown rot fungi showed unique cellulose decomposition patterns. In contrast, litter decomposers have unique genomic signatures in relation to the depolymerization of hemicellulose and lignin, suggesting unique adaptations to the soil environment. Furthermore, we found evidence that both under the terms litter decomposer and white rot there are species with deviating plant cell wall decomposition characteristics suggesting that these terms mask a much larger functional diversity.