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Coordinated deconstruction of lignocellulose by wood decay fungi

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In the context of sustainable development of lignocellulosic biorefinery, lignolytic fungi are of particular interest. Among wood decay fungi, white-rot fungi produce and secrete a plethora of enzymes able to degrade the three main polymers in plant biomass: cellulose, hemicelluloses and lignin. Those fungi are thereby a source of enzymes of interest to the modern human industries. The Basidiomycetes fungi from the genus *Pycnoporus* have been studied for their efficiency in numerous biotechnological applications related to their capacity to degrade lignin and to secrete laccases. In particular, *P. coccineus* CIRM-BRFM 310 has been shown to efficiently modify woody substrates. In order to identify key sets of enzymes involved in lignocellulose deconstruction, we combined genomics, transcriptomics, and secretomics data and analyzed the early response of the fungus to diverse model plant biomass, representative of Gramineae, softwood and hardwood. Among the co-regulated genes, we identified proteins active on lignin (manganese peroxidases, lignin peroxidases) and their partner redox enzymes (GMC oxido-reductases, glyoxal oxidases). The oxidative machinery for lignocellulose breakdown was completed by lytic polysaccharide monooxygenases that cleave cellulose via an oxidative process (LPMOs). A few enzymes active on hemicelluloses (e.g., xylanases, acetyl esterases) were co-regulated with enzymes active on lignin, suggesting that the fungi simultaneously targets those two polymers for efficient lignocellulose breakdown. Complex sets of enzymes fused to a cellulose binding module were co-regulated and simultaneously secreted, suggesting that the attack of lignocellulose involves the coordinated action of several enzymes that could co-localize in the plant cell wall.

Biography

Marie-Noelle Rosso has completed her PhD in 1996 at Aix-Marseille Université, France. She has worked for about 18 years on molecular plant-microbe interactions at INRA and is now focusing on wood decay fungi and their adaptations to plant cell wall degradation. She is the Deputy Director of the laboratory of Diversity and Biotechnology of Fungi, INRA-Aix-Marseille University. She is currently coordinating a community sequencing program on polyporales run at the Joint Genome Institute, US and a project on fungi-inspired enzyme cocktails for the deconstruction of plant biomass, funded by the French National Research Agency.

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