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Survey of fungal lignocellulose-acting enzymes for improved plant biomass degradation capacities

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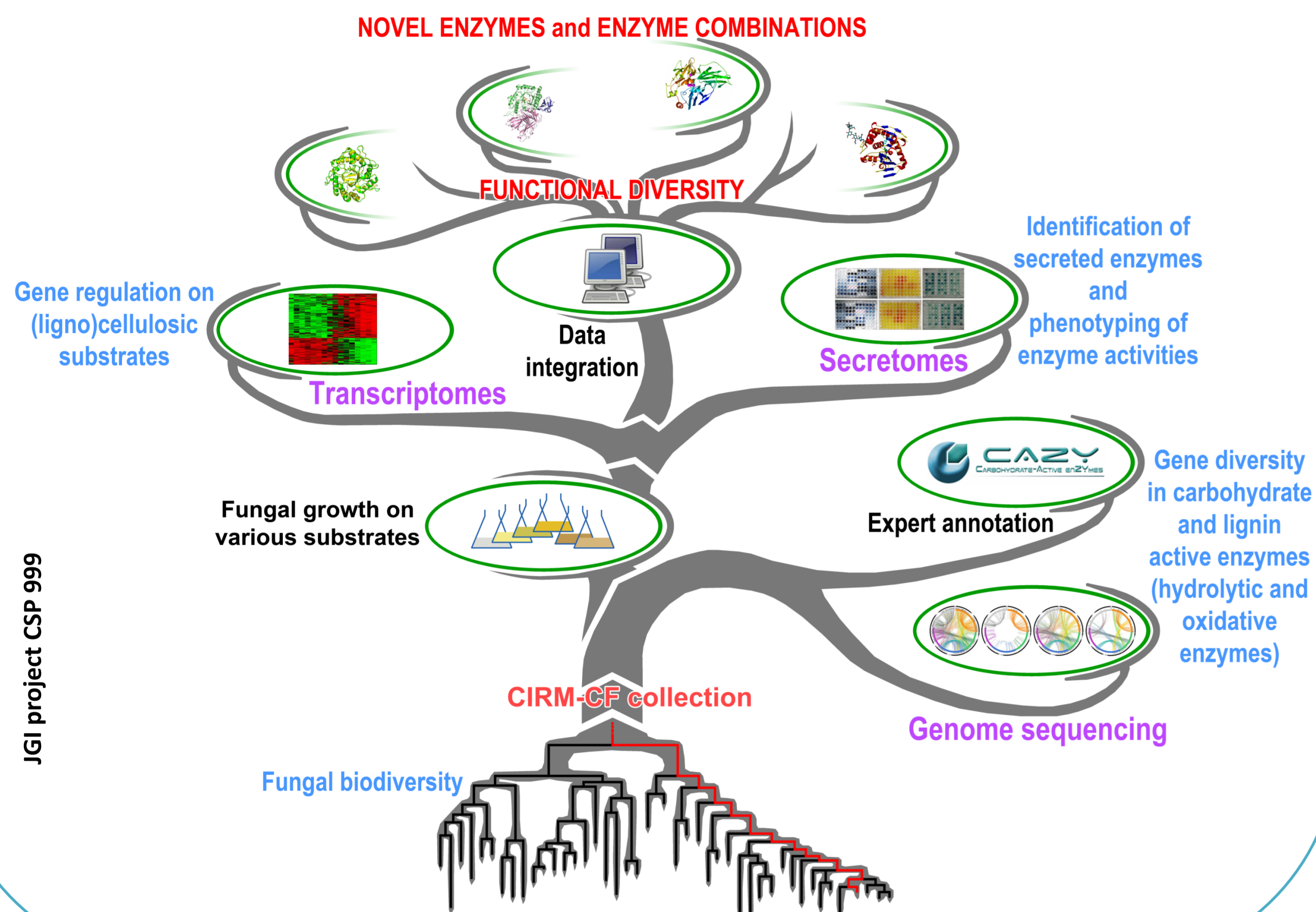
Survey of fungal lignocellulose-acting enzymes for improved plant biomass degradation capacities

Eric Record, Anne Lomascolo, Anne Favel, David Navarro, Laurence Lesage-Meessen, Annick Doan, Mireille Haon, Christophe Boyer, Sabine Taussac, Sacha Grisel, Emmanuel Bertrand, Sana Raouche, Isabelle Gimbert, Jean-Guy Berrin, Marie-Noëlle Rosso, Craig Faulds

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Comparative genomics of fungal enzyme machinery

- Filamentous fungi are the most potent degraders of lignocellulosic biomass
- They secrete high number and a broad variety of carbohydrates-active enzymes and lignin-active enzymes (CAZymes) Levasseur et al. 2013. Lombard et al. 2013.

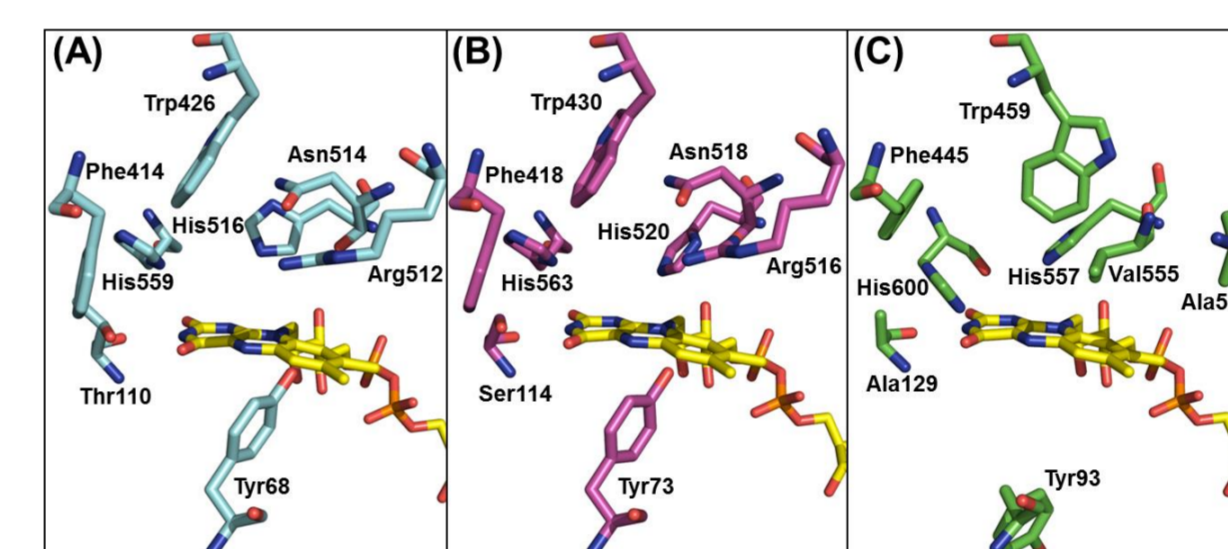


Genome sequencing and enzyme characterization

- CIRM a Biological Resource Center dedicated to the preservation of filamentous fungi of interest to agro-industries and their utilization (<http://www6.inra.fr/cirm/Champignons-Filamenteux>)
- The first genome sequence : *Pycnoporus cinnabarinus* : fungal model to study the enzyme mechanism to degrade lignin Levasseur et al. 2014.

Family	Total gene number
AA1 (multi-copper oxidases)	5 laccases <i>sensu stricto</i> , 1 Mco, 1 ferroxidase
AA2 (class II peroxidases)	12 (4 LiP, 1 VP, 1 atypical-VP, 3 short-MnP, 2 chloroP, and 1 partial protein)
AA3_1 (cellulose dehydrogenase)	1
AA3_2 (AAO, glucose oxidase/dehydrogenase)	19
AA3_3 (alcohol oxidase/dehydrogenase)	2
AA3_4 (pyranose oxidase)	2
AA5_1 (copper radical oxidases)	7 (3 Glyoxal oxidases <i>sensu stricto</i> , 4 Cro)
AA6 (benzoquinone reductase)	1
AA8	1
AA9 (LMPO)	15
Total	60

- Enzyme characterization, structure/function studies, chimerical enzymes (bi-functional), enzyme synergy
- Applications of enzymes for lignin valorization (Indox project)

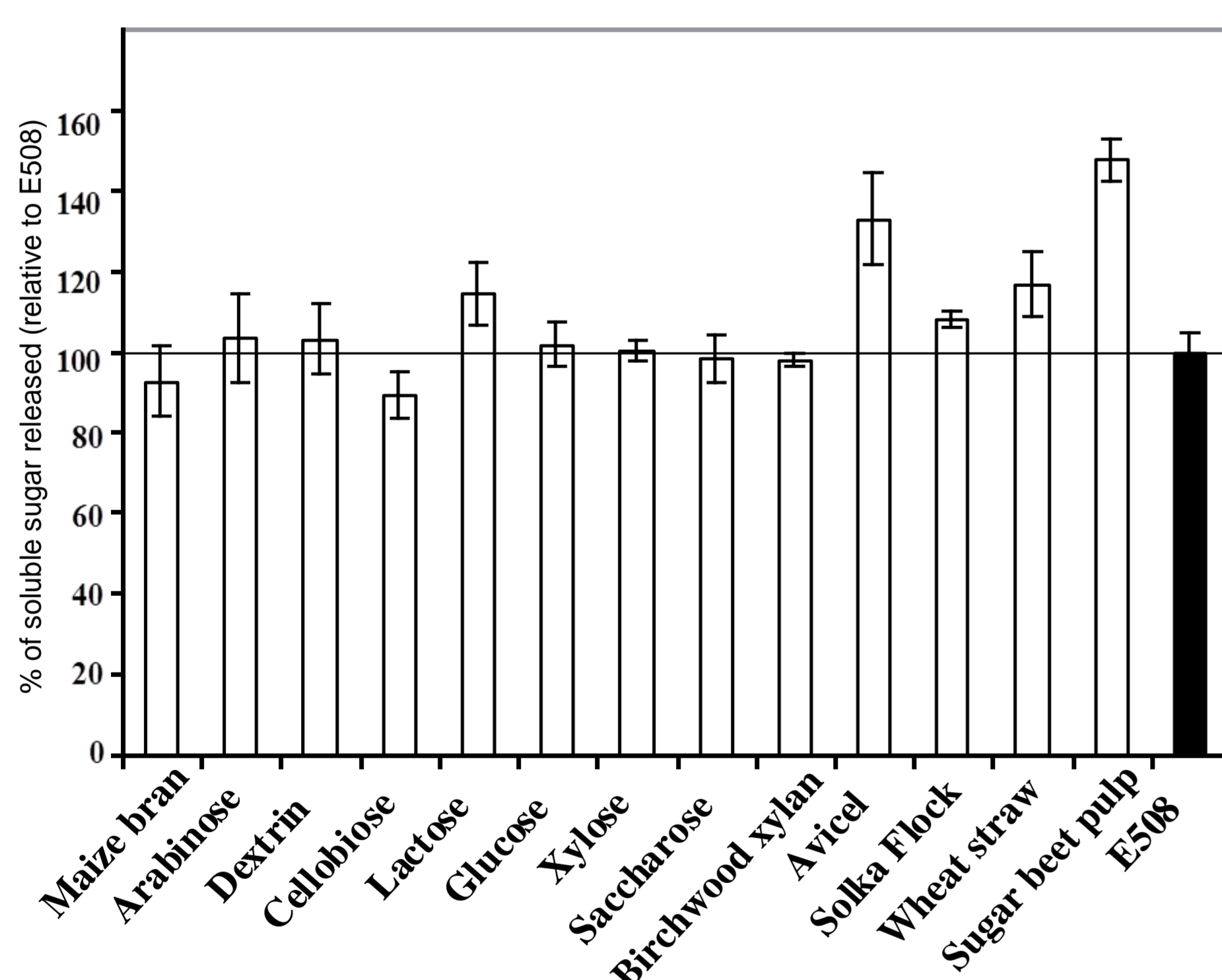
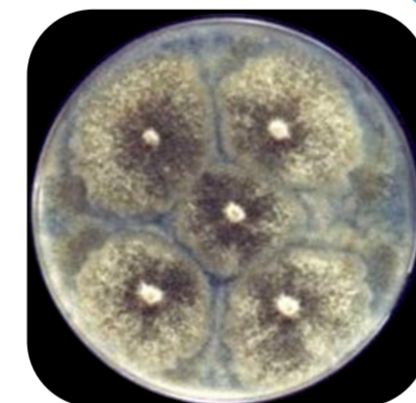


Fungal secretome analysis

- Podospora anserina* : coprophilous fungus model adapted to complex biomass conversion
- Pestalotiopsis sp.* : mangrove fungal model to study salt-adapted enzymes

Poidevin et al. 2014

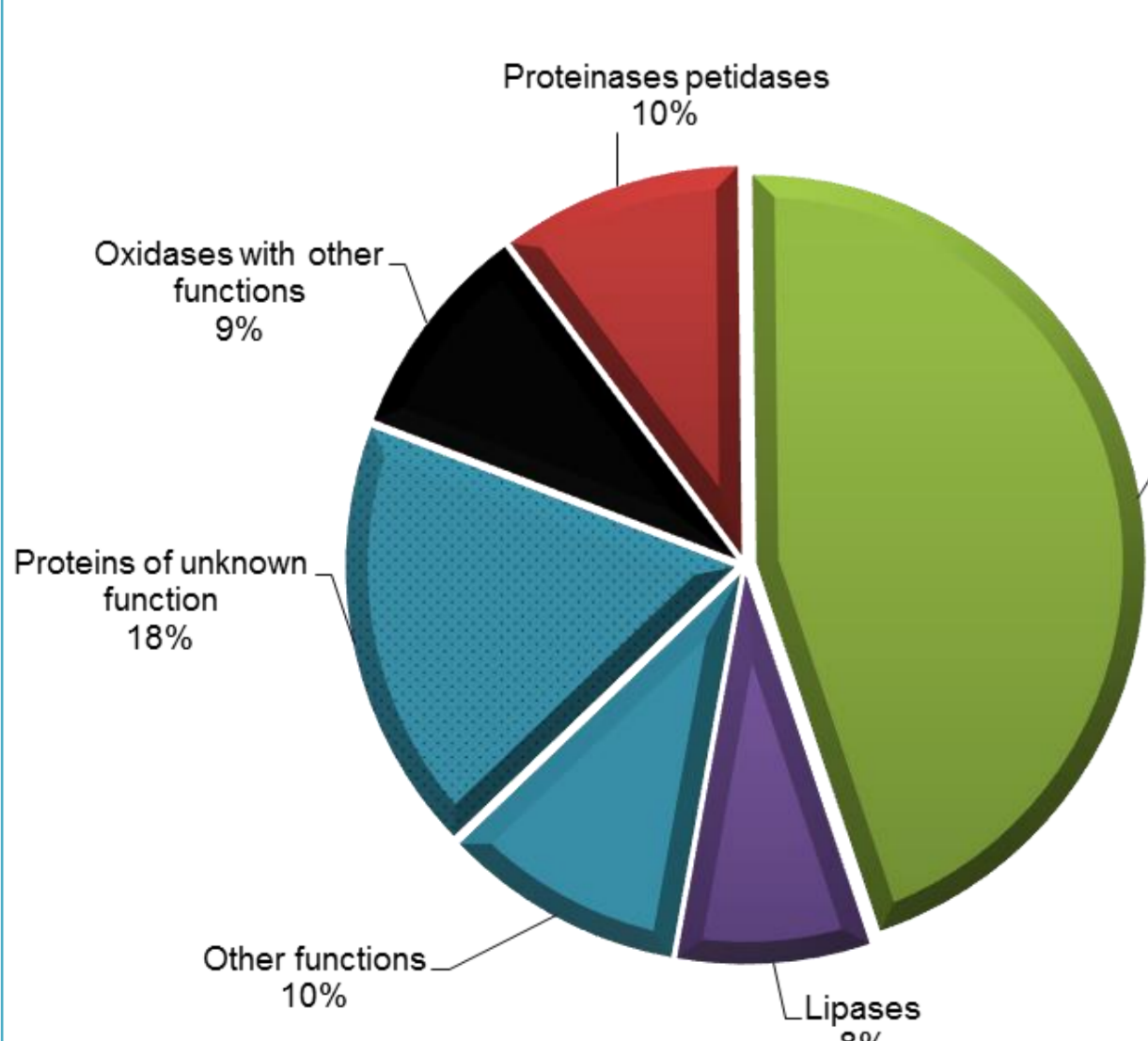
Podospora anserina



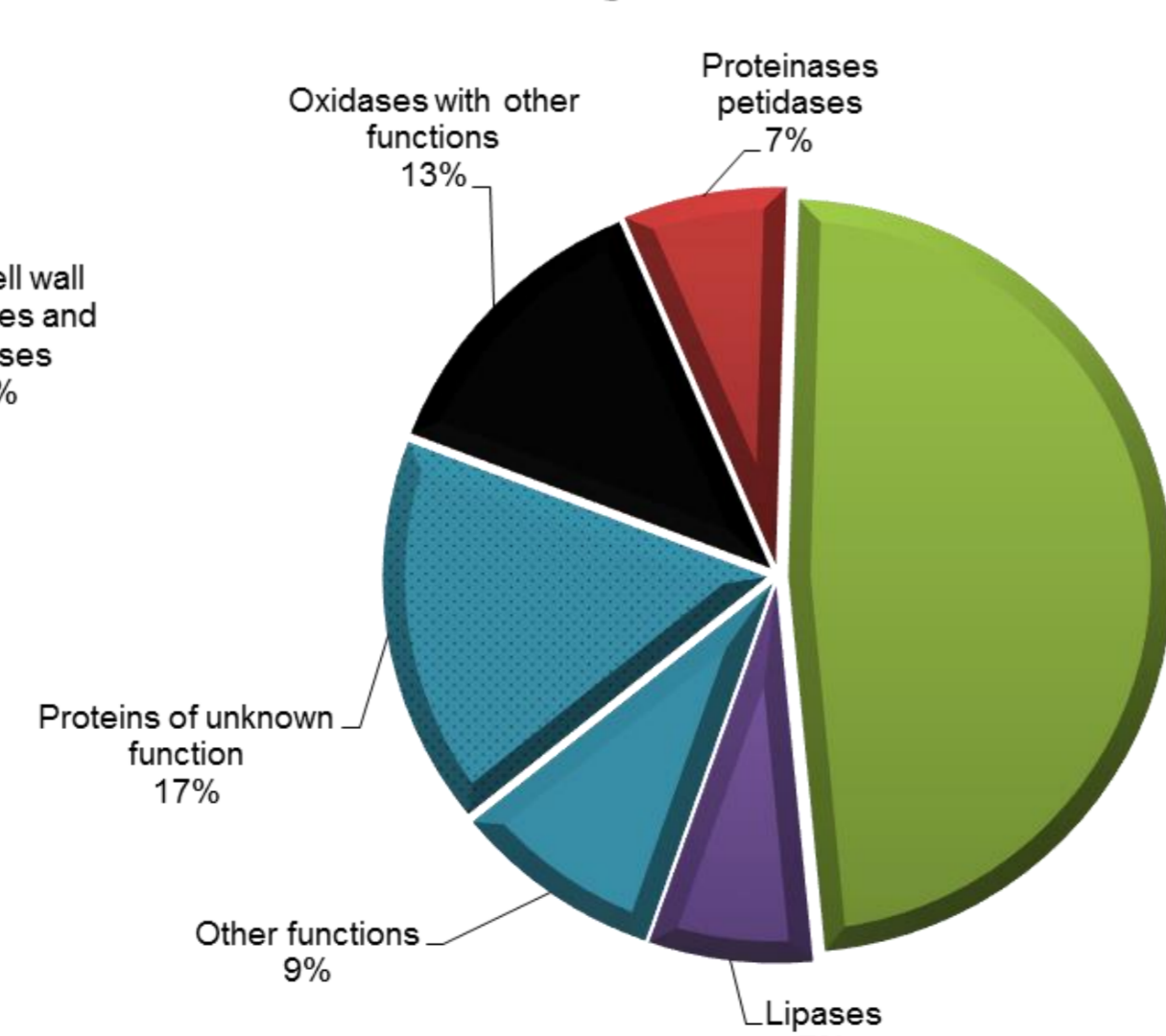
Wheat straw hydrolysis by *T. reesei* cellulases (E508) supplemented by *P. anserina* secretomes

Proteomic analyses

Avicel



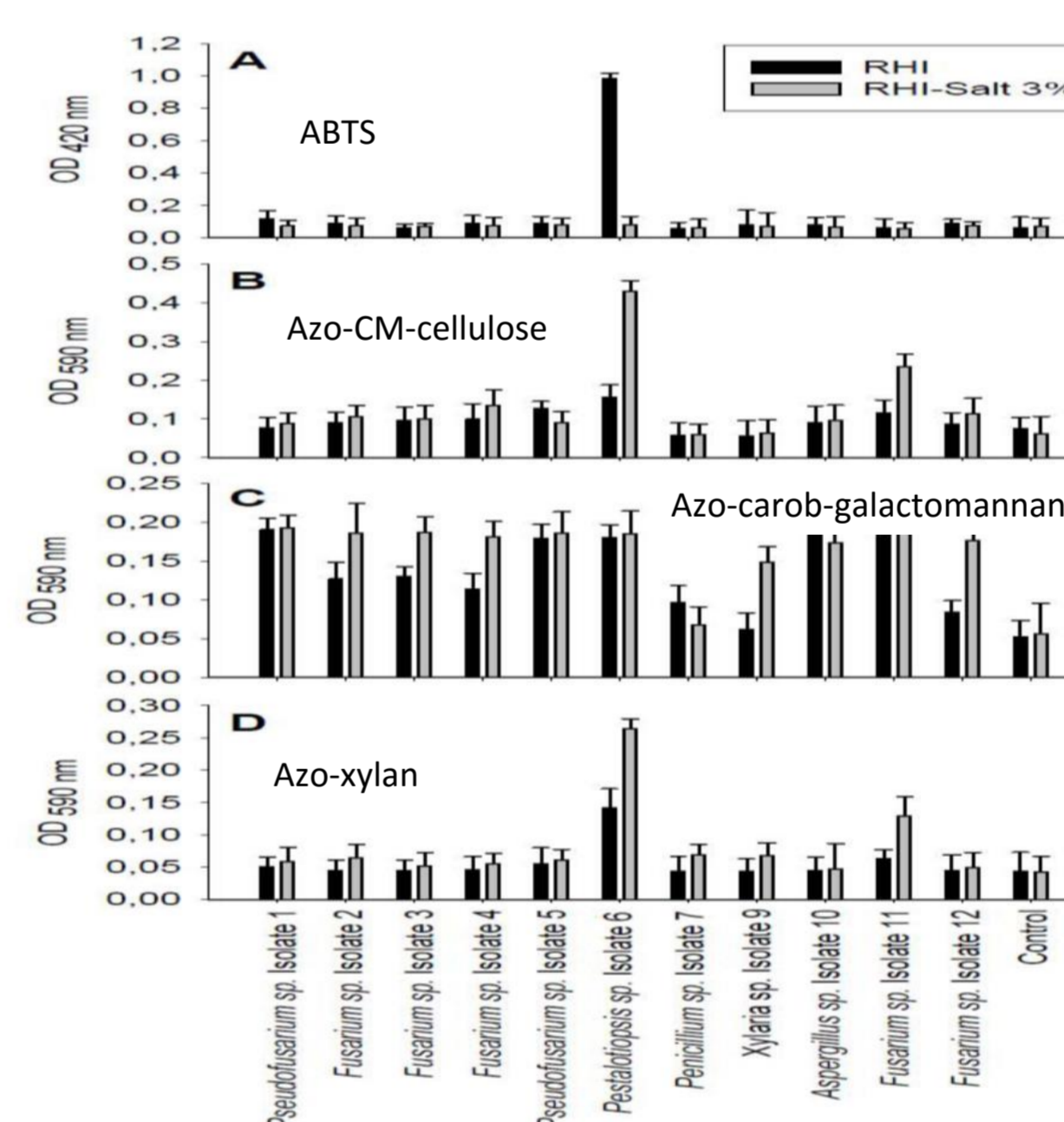
Sugar Beet Pulp



Functional category analysis of the 142 proteins detected in *P. anserina* secretomes grown on Avicel and Sugar Beet Pulp.

Arfi et al. 2013.

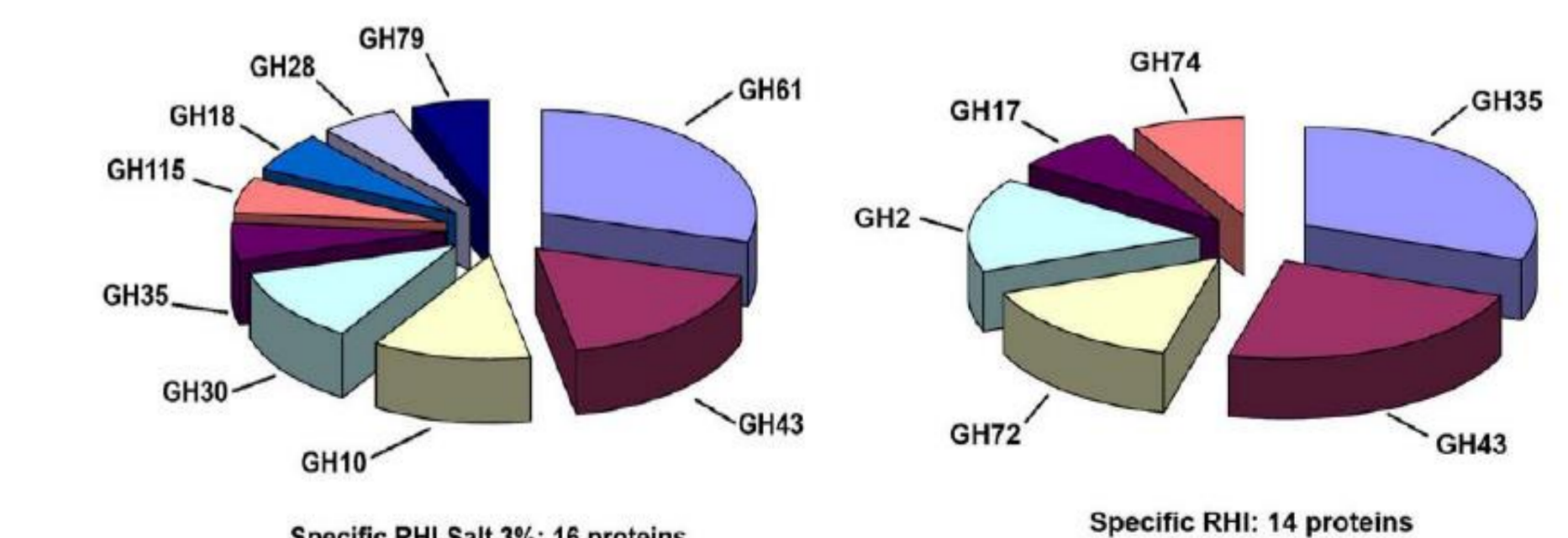
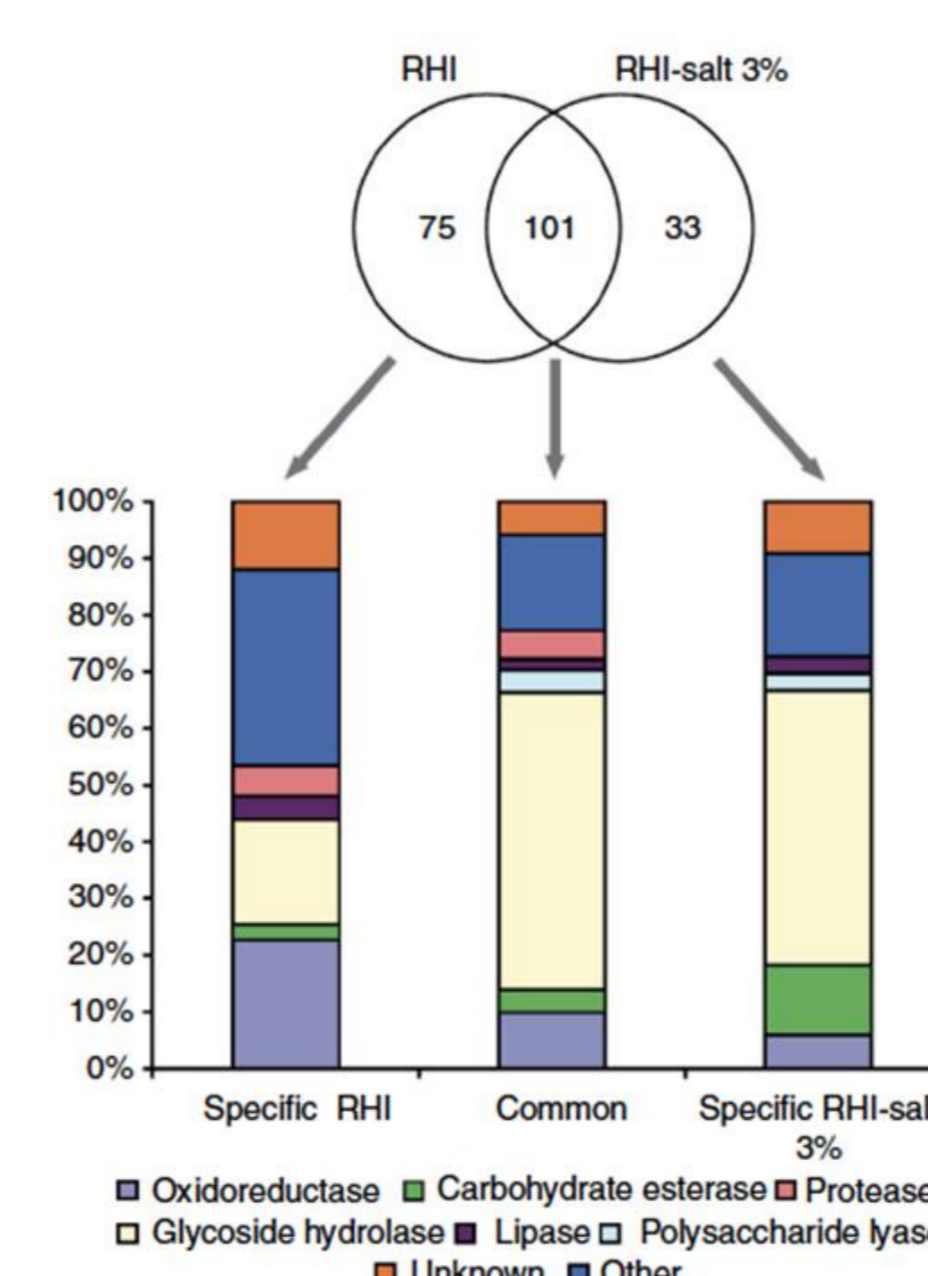
Pestalotiopsis sp.



Rhizophora stylosa

Identification of salt tolerant enzymes : lignocellulolytic activity screening of isolated mangrove fungi after 8 days cultivation on non-saline or 3% saline conditions

Proteomic analyses



Salinity => Xylanases (GH43, GH10, GH30)
=> Cellulases (GH61, AA9 LPMO)

209 identified proteins with differential secretion : secretion of oxidoreductases found to be limited under saline conditions while cellulase and hemicellulase secretion were increased.