



**HAL**  
open science

## Functional phenotyping of filamentous fungi from a Biological Resource Center: application to the bioremediation of creosote-treated wood

Fanny Seksek, Isabelle Gimbert, Quentin Albert, Safwan Saker, Eric Masson, Delphine Chaduli, Catherine Heilmann, Anne Favel, David Navarro

### ► To cite this version:

Fanny Seksek, Isabelle Gimbert, Quentin Albert, Safwan Saker, Eric Masson, et al.. Functional phenotyping of filamentous fungi from a Biological Resource Center: application to the bioremediation of creosote-treated wood. International Mycological Congress, Aug 2024, Maastricht, Netherlands. 2024. hal-04692033

**HAL Id: hal-04692033**

**<https://amu.hal.science/hal-04692033v1>**

Submitted on 9 Sep 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Copyright



# Functional phenotyping of filamentous fungi from a Biological Resource Center: application to the bioremediation of creosote-treated wood.

Fanny Seksek<sup>1</sup>, Isabelle Gimbert<sup>1</sup>, Quentin Albert<sup>1,3</sup>, Safwan Saker<sup>2</sup>, Eric Masson<sup>2</sup>, Delphine Chaduli<sup>1,3</sup>, Catherine Heilmann<sup>1,3</sup>, Anne Favel<sup>1,3</sup>, and David Navarro<sup>1,3</sup>.



**Cirm**  
Champignons filamenteux

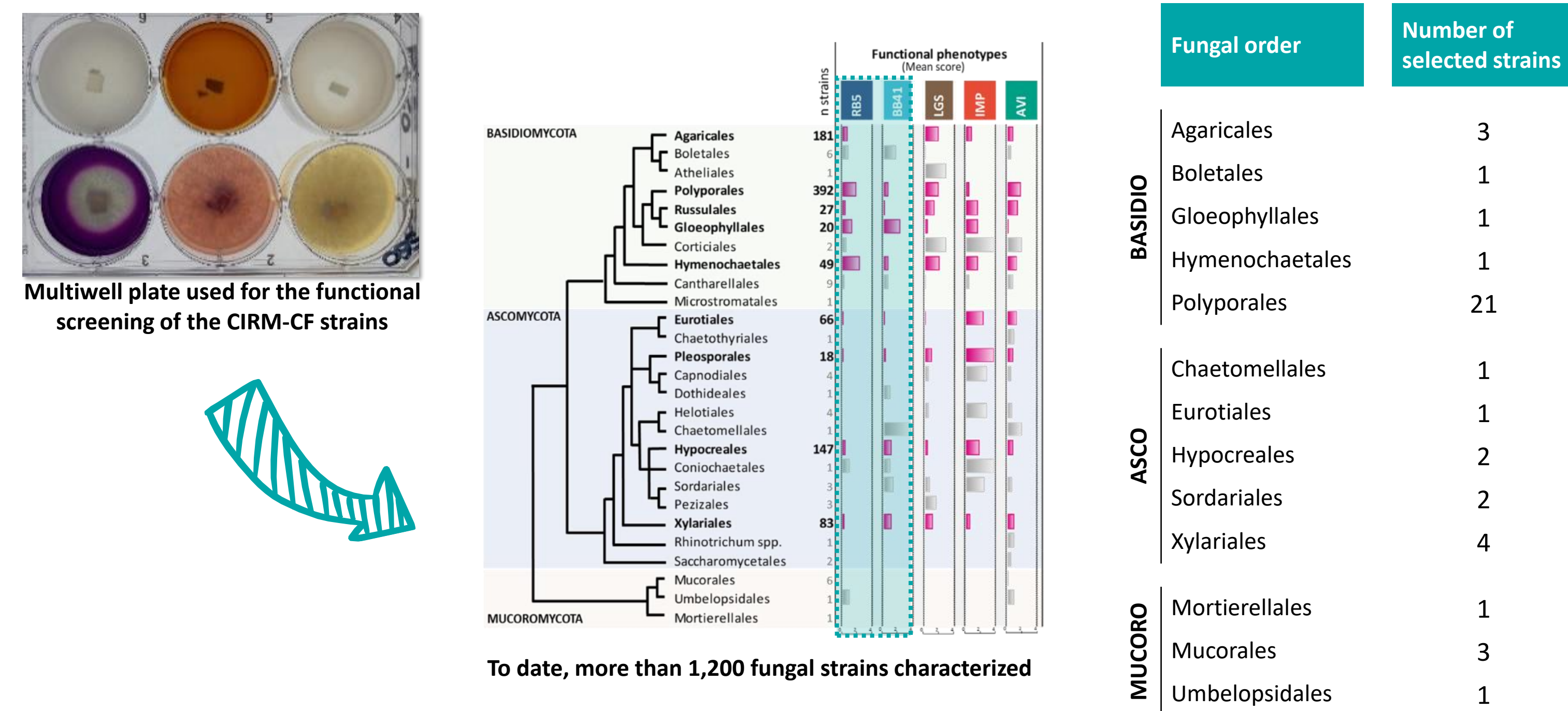
- UMR1163, Biodiversité et Biotechnologie Fongique, Aix Marseille Université, INRAE, 13288 Marseille, France
- CRITT Bois, 27 rue Philippe Seguin, F88000 Epinal, France
- CIRM-CF, INRAE, Aix Marseille Université, UMR1163, 13288 Marseille, France

## Background

CIRM-CF is a Biological Resource Center (BRC) preserving and offering to the scientific community more than 3,000 fungal strains mainly involved in plant biomass transformation. To provide users with useful information on strains, we launched a large-scale functional phenotyping program to assess their degradation potential towards industrial and recalcitrant compounds (synthetic dyes, lignocellulose-derived compounds and plastic polymer). With over 1,200 strains now characterized, we can draw up a functional map to guide the selection of fungal taxa to be tested for biotechnological applications (PMID: 34267314). Here, we proposed to take advantage of this open data, to screen effective strains under solid-state fermentation for the bioremediation of polyaromatic hydrocarbons (PAHs) in creosote-treated wood.

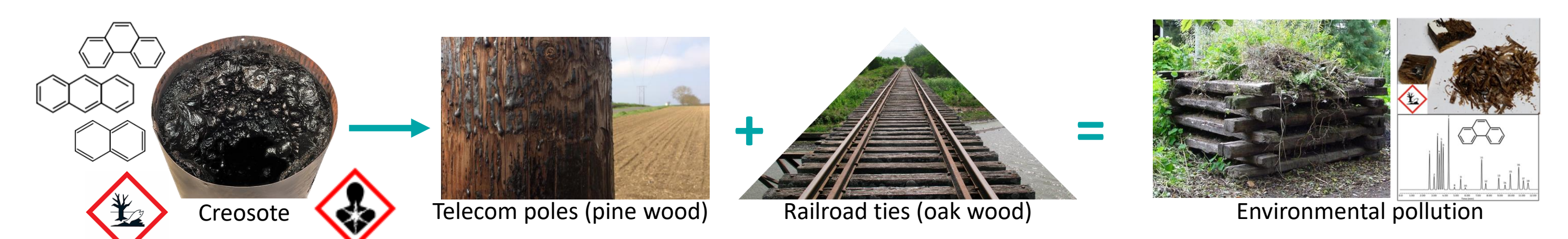
## Strains selection

Based on their abilities to degrade azo dyes<sup>1</sup>, and their biotope of origin, we selected 42 fungal strains (and species) from the Biological Resource Center CIRM-CF to test their potential in creosote-treated wood bioremediation.



1. Navarro, D. et al. Large-scale phenotyping of 1,000 fungal strains for the degradation of non-natural, industrial compounds. *Commun Biol* 4, 871 (2021).

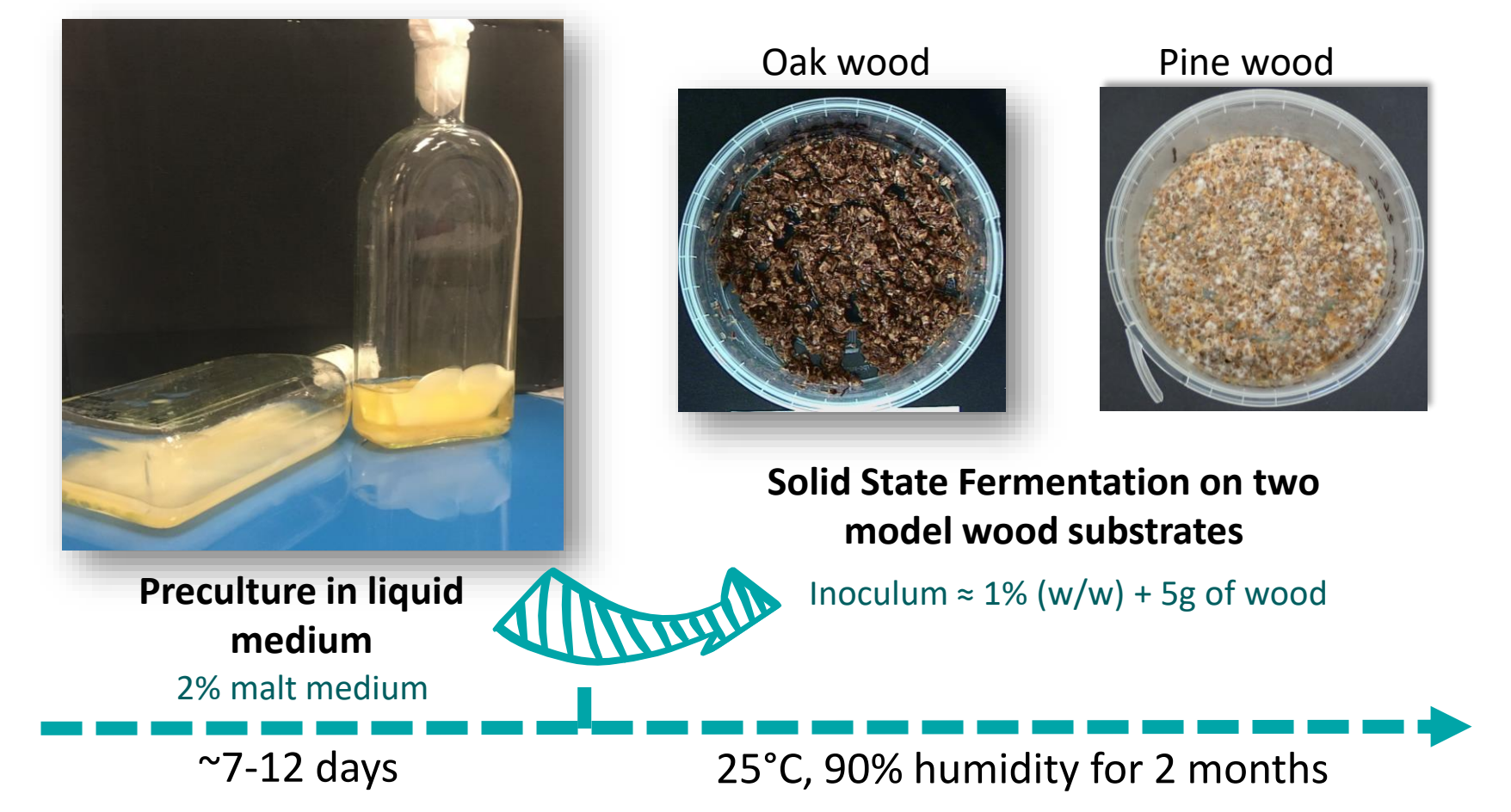
## Solid State Fermentation of creosote-treated wood



### Experimental design

	Oak	Pine
Abiotic control	Duplicate	Duplicate
Non creosoted	Duplicate	Duplicate
Creosoted 10% creosote oil	Duplicate	Duplicate

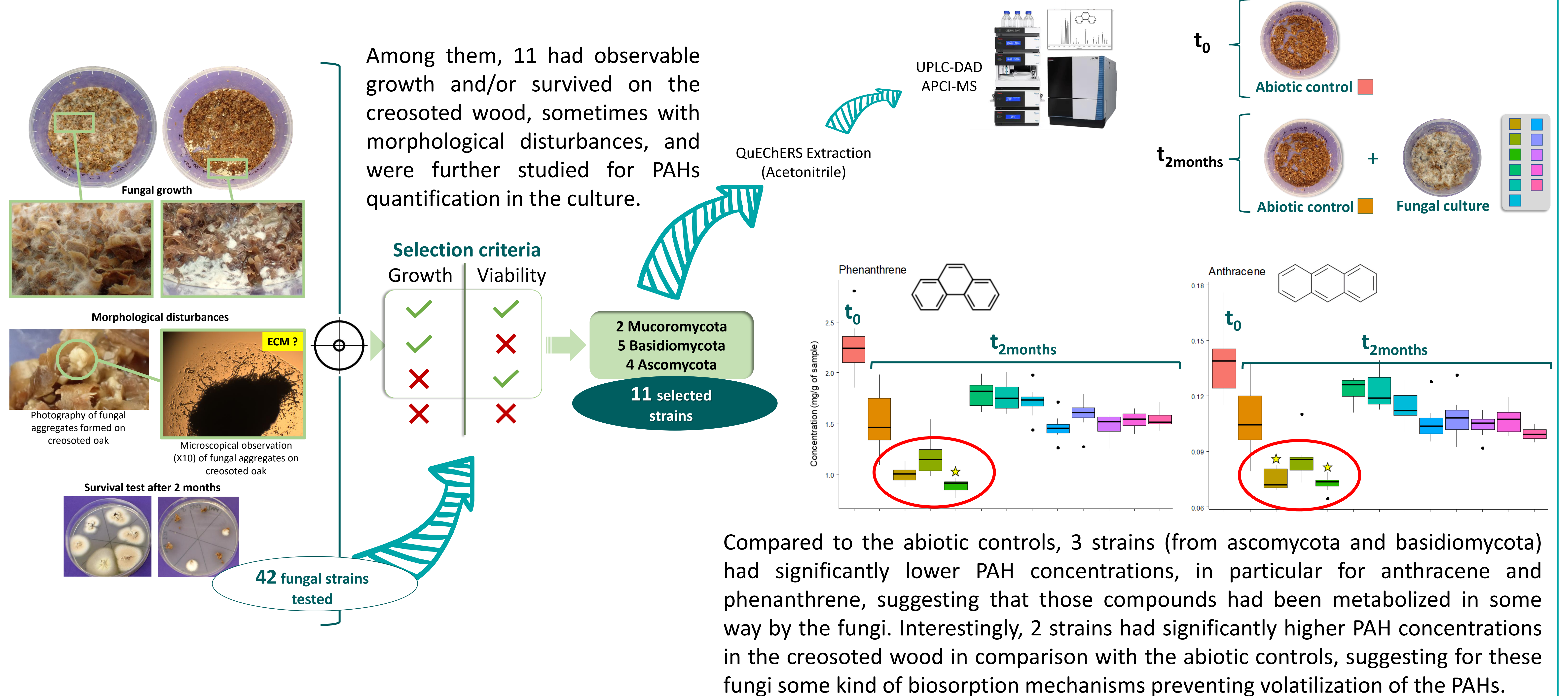
- Observation and comparison of fungal growth
- Survival test after 2 months
- PAHs degradation (UPLC-UV-CAD-MS)



We prepared two models of creosote-treated wood, from oak and pine chips, in order to setup boxed-SSF assays for the screening of efficient strains.

## Results

The selected strains were screened for their ability to grow in SSF on creosoted wood and to degrade the PAHs present in this wood.



Compared to the abiotic controls, 3 strains (from ascomycota and basidiomycota) had significantly lower PAH concentrations, in particular for anthracene and phenanthrene, suggesting that those compounds had been metabolized in some way by the fungi. Interestingly, 2 strains had significantly higher PAH concentrations in the creosoted wood in comparison with the abiotic controls, suggesting for these fungi some kind of biosorption mechanisms preventing volatilization of the PAHs.

## Conclusions

We proposed to use the functional phenotyping of the CIRM-CF collection, to select efficient strains in the bioremediation of creosote-treated wood, in order to make end-life wood (railroad ties and telecom poles) recyclable again. From the CIRM-CF, we selected for the screening 42 strains able to decolorize two azo dyes (RB5 and BB41), ability often related to lignin-degrading enzymes<sup>2</sup>. Among them, we showed that 11 strains had been able to grow and/or to survive on creosote-treated wood, and 3 strains seem efficiently degrade PAHs. So we have shown that large-scale phenotyping of the CIRM-CF collection has been a useful tool in pre-selecting strains for a dedicated application: the bioremediation of creosote-treated wood. Noteworthy, all of the efficient strains in SSF assays for PAHs degradation had also shown strong capacity to decolorize BB41, but not always the RB5. This suggests that BB41 decolorization could be an accurate way to select effective fungal strains for the transformation of aromatic compounds from plant biomass or pollutants in the bioeconomy.

2. Chen H. Recent advances in azo dye degrading enzyme research. *Curr Protein Pept Sci.* 2006 Apr;7(2):101-11. doi: 10.2174/138920306776359786. PMID: 16611136; PMCID: PMC5863238.