



**HAL**  
open science

## Structural and functional traits of the basidiomycete *Trametes versicolor* are biomarkers for the assessment of soil ecotoxicity

Albert Kollmann, Jérémie D. Lebrun, Nelly Wolff, Nathalie Cheviron, Claude Jolival, Isabelle Gattin, Christian Mougin

### ► To cite this version:

Albert Kollmann, Jérémie D. Lebrun, Nelly Wolff, Nathalie Cheviron, Claude Jolival, et al.. Structural and functional traits of the basidiomycete *Trametes versicolor* are biomarkers for the assessment of soil ecotoxicity. SETAC Europe 18th Annual Meeting, May 2008, Varsovie, Poland. 2008. hal-02751859

**HAL Id: hal-02751859**

**<https://hal.inrae.fr/hal-02751859v1>**

Submitted on 14 Mar 2023

**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.

# STRUCTURAL AND FUNCTIONAL TRAITS OF THE BASIDIOMYCETE *TRAMETES VERSICOLOR* ARE BIOMARKERS FOR THE ASSESSEMENT OF SOIL ECOTOXICITY ?

Kollmann Albert, Lebrun Jérémie, Wolff Nelly, Cheviron Nathalie, Jolival Claude\*, Gattin Isabelle\*\* and Mougin Christian

UR251 Physicochimie et Ecotoxicologie des Sols d'Agrosystèmes Contaminés, INRA, Route de Saint-Cyr, F-78026 Versailles, France

\*UMR 7573, Laboratoire de Biochimie, ENSCP, 11 rue Pierre et Marie Curie, F-75231 Paris cedex 05, France

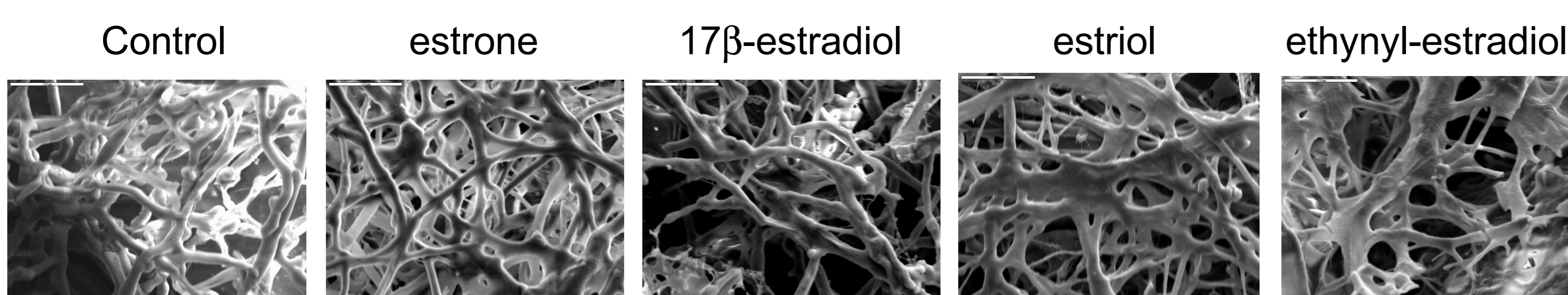
\*\*Biosol, ESITPA, 13 Rue du Nord, F-76000 Rouen, France

## Rationale / objectives

- Fungi constitute one of the largest biomass in the soil, and are responsible of key environmental functions.
  - As a consequence, they may be pertinent indicators for soil ecotoxicity assessment.
- Our objectives are i) to understand the physiological basis of structural and functional disturbances of these organisms after exposure to pollutants, ii) to develop fungal-based tools for soil ecotoxicity assessment.

## Pollutants alter the morphology of fungal hyphae

The effects on fungal morphology were assessed by treating pure cultures of *T. versicolor* with estradiol, estrone, estriol and ethynyl-estradiol. Each hormone was provided at 0.01 mM in the culture medium. The effects were assessed by SEM after 4 days of exposure.

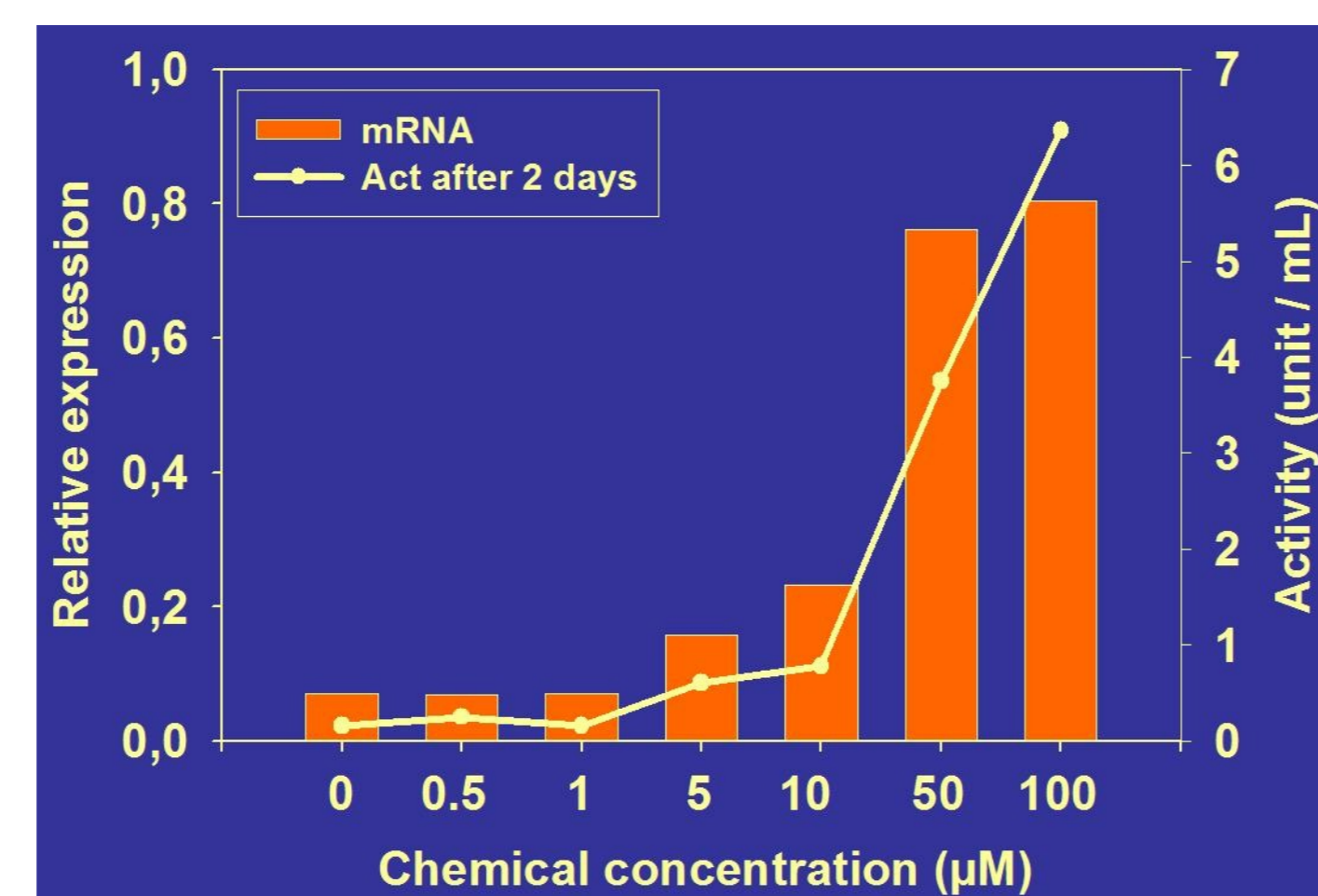
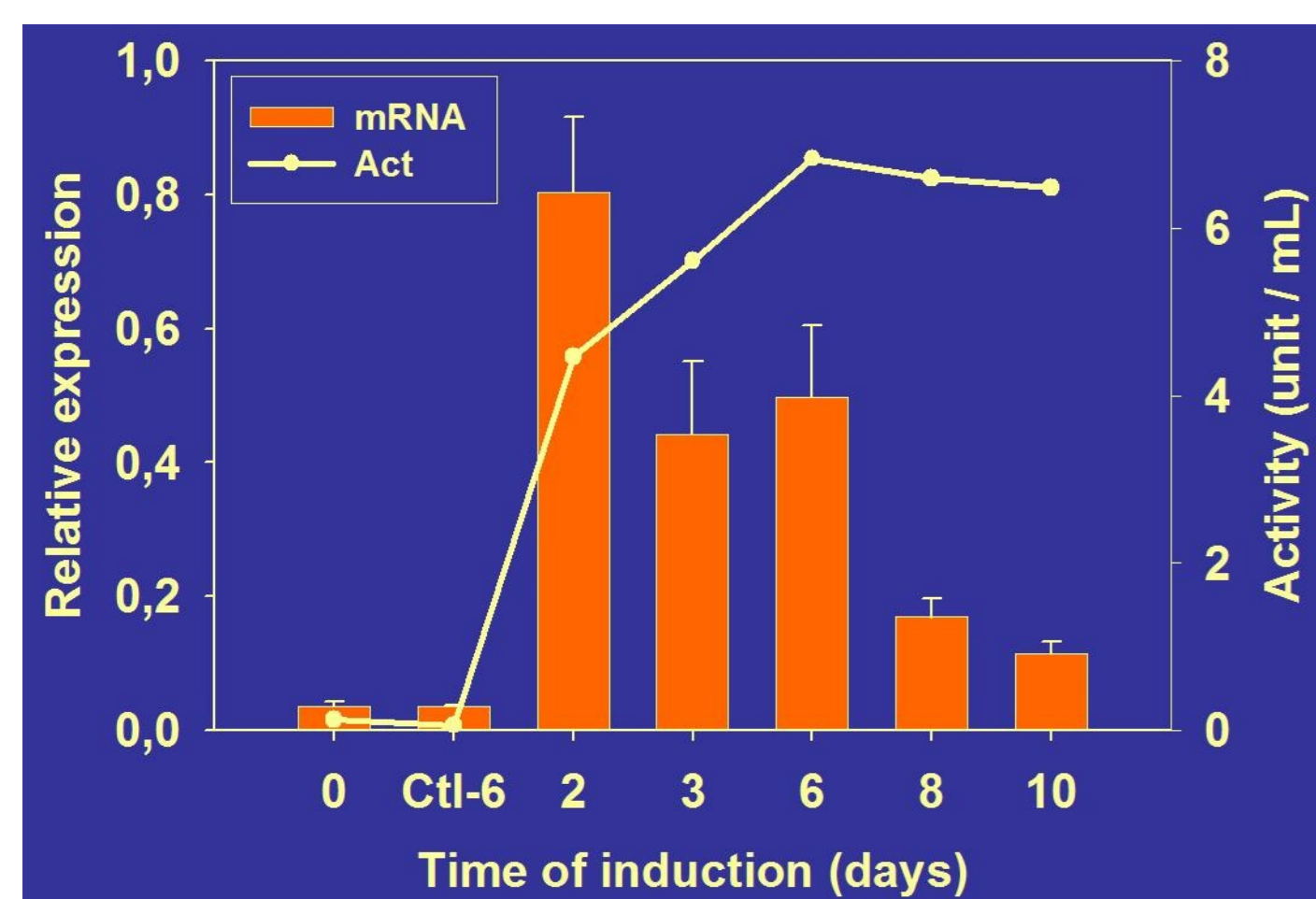


► Different morphological alterations arise from fungal exposure to estrogens, even at lower concentrations (10<sup>-6</sup> mM). Ethynyl-estradiol induces an unusual hyphae morphology. 17β-estradiol seems the less active compound, because of its rapid biotransformation by the fungus.

- Other effects have been previously noticed after exposure to heavy metals, including hyphae shrinkage, reduced index of ramification and roughness.
- Image analysis will be used to quantify these morphological alterations, and establish a typology by family of pollutants.

## Pollutants have effects at the transcriptomic level

The effects of pollutants on mRNA production were assessed by treating pure cultures of *T. versicolor* with 2,5-dimethylaniline. After different durations of exposure, mRNAs encoding laccase of type A were extracted and quantified by Q-PCR. In parallel, enzymatic activity was measured using ABTS as a substrate.



► Fungal exposure to 2,5-dimethylaniline results in a time-dependent and dose-dependant synthesis of mRNA encoding the laccase. That induction well corresponds to an increase of enzymatic activity.

► Similar effects are observed with environmental pollutants such as herbicides and endocrine disrupters.

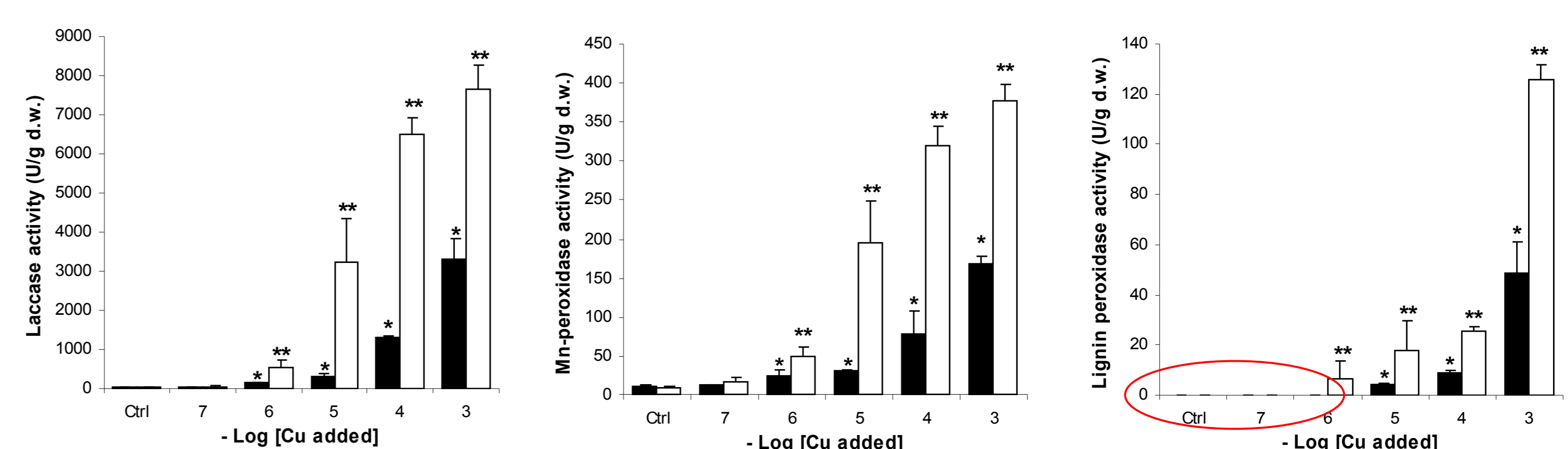
## Pollutants modify the activity of oxidases

The effects of pollutants on the activity of the oxidases secreted by *T. versicolor* were assessed by treating pure cultures with copper in media exhibiting moderate (black bars) or low (white bars) metal complexing properties. After 7 days of exposure, activities of secreted enzymes were measured using UV-Vis spectrophotometry.

► Laccase and Mn-peroxidase are constitutive enzymes in *T. versicolor*. Their activity is increased after exposure to Cu, with a dose-response relationship. A low complexing medium, allowing a high metal bioavailability, increases the sensitivity of the response.

► Lignin peroxidase is not constitutive in *T. versicolor*. It is specifically expressed in the presence of copper.

► Similar effects have been previously observed on laccase activity with other environmental pollutants such as herbicides, endocrine disrupters, and heavy metals.



## Conclusions

- 1) In pure cultures, structural and functional traits of *T. versicolor* are affected by fungal exposure to environmental pollutants.
- 2) Additional studies are needed to assess the sensitivity and selectivity of the responses.
- 3) Methodologies have to be developed to perform studies in soils.