SCIENCES & BIOENGINEERING SCIENCES

The Research Group
PLAN

has the honor to invite you to the public defence of the PhD thesis of

Maarten Gregory Paul-Luc Ottaway

to obtain the degree of Doctor of Bioengineering Sciences

Title of the PhD thesis:
Impact of trace metals on ectomycorrhizal symbiosis with an emphasis on the role of cellular redox regulation

Supervisor:
Prof. dr. Joske Ruytinx (VUB)

The defence will take place on

21st of May, 2026 at 5 p.m.

VUB Etterbeek campus, Pleinlaan 2,
Elsene, building D, room D.2.01

Members of the jury

Prof. dr. ir. Geert Angenon (VUB, Chair)
Prof. dr. Joris Messens (VUB)
Prof. dr. Luc Leyns (VUB)
Prof. dr. Ann Cuypers (UHasselt)
Dr. Claire Veneault-Fourrey (INRAe Nancy)

Curriculum vitae

Maarten Ottaway obtained his master's degree in Biology: Molecular and Cellular Life Sciences in 2020 at the Vrije Universiteit Brussel. After graduating, he started his PhD in November of 2020 at the research groups of Microbiology and Plant Genetics: Plant-Microbe Interactions at the VUB, supervised by Joske Ruytinx. In 2021 he obtained his FWO Fundamental Research PhD Fellowship in 2021.

With his research, he provided new insights into the stress response of the ECM symbiosis. This research resulted in a peer-reviewed publication and multiple (international) conference posters.

Abstract of the PhD research

Metal pollution of soils puts significant strain on plants and soil-borne organisms, such as fungi. Uptake of these pollutants causes cellular damage through, for example, the accumulation of reactive oxygen species (ROS). While ROS typically cause damage, they also play a role in stress response signalling. Ectomycorrhizal (ECM) fungi form a mutualistic symbiosis with most trees in the northern hemisphere. However, the impact of soil metal pollution on the formation of this symbiosis has not yet been investigated. This PhD research aimed to assess the impact of both zinc (Zn) and cadmium (Cd) pollution on ECM symbiosis formation between the ECM fungus *Laccaria bicolor* and poplar, as well as determine the role of ROS as signalling molecule within this fungus.

First, the impact of Zn or Cd stress on symbiosis development was assessed. Exposure to either metal revealed a different adaptation strategy of the symbiosis to Zn as opposed to Cd. Furthermore, Cd seemed to stimulate the formation of this symbiosis, while Zn pollution decreased symbiosis development.

Next, part of the individual fungus was exposed to Zn or Cd to determine if ROS play a signalling role within ECM fungi. Enzymatic assays revealed Cd, but not Zn, to induce a stress response in the indirectly exposed part of the fungus, suggesting a signalling role for ROS within this species. Two H_2O_2-sensitive biosensors were optimised for expression within *L. bicolor*, and their successful expression will allow for significant progress to be made regarding redox processes within ECM fungi.

Lastly, a predicted ROS-responsive transcriptional regulator from *L. bicolor* was characterised. Bioinformatics analysis and microscopy indicate this regulator to behave differently from similarly structured, characterised transcriptional regulators found in yeasts and pathogenic fungi.

This work provides new insights into the resilience of the ECM symbiosis and provides a solid base for future redox research within ECM fungi.