BRAIN-be
Belgian Research Action through Interdisciplinary Networks

RESIPATH

Responses of European Forests and Society to Invasive Pathogens

DURATION
15/12/2013 - 14/12/2016

BUDGET
€ 201 911

PROJECT DESCRIPTION

1. Context
Invasive pathogens in forests generally occur at a large scale affecting tree species with a widespread distribution in Europe. In this project we will focus on four such tree species and their associated invasive pathogens: elm and *Ophiostoma novo-ulmi*, ash and *Chalara fraxinea*, alder and *Phytophthora alni* and oak and *Erysiphe alphitoides/Phytophthora cinnamomi*. These diseases were selected because of their impact and their differences in pathogenicity and current distribution. The selected tree species are an important part of forest ecosystems but also have an economic, recreational and cultural value. Hence, studying the impact of these diseases requires a multidisciplinary approach. Determination of this impact but also assessing the response of the tree species to such invasions are the first two work packages (WP1 and WP2) of this project. Due to the large economical and ecological impact of invasive pathogens, it is important to detect them early and to find ways to restrict their spread. Those objectives are addressed in WP3 and WP4, the two parts of the project to which the Belgian partners (ILVO and CRA-W) contribute. In the last work package (WP5) the public perception of the impact of invasive forest pathogens will be determined.

2. General objectives and underlying research questions
The general objective of the RESIPATH project is to study how European forest communities have been affected by and responded to invasive pathogens and to develop means to mitigate their impact. The objectives of the work packages in which the Belgian partners are involved are listed below.

In WP3 we will focus on the mechanisms of hybridization in *Phytophthora* species. This relates to the hypothesis that *Phytophthora* species that were previously separated are now coming into contact due to an increase in the international traffic of plants between nurseries. At these nurseries the *Phytophthora* species can hybridize, with the potential formation of more virulent new species. A first objective of this work package is to develop sensitive methods to detect these hybrids and identify their parental species. A second objective is to test the hypothesis about the creation and transfer of hybrid species via nurseries. An international collection of *Phytophthora* species from different ecological niches (forests, rivers, nurseries) will be tested with the new methods to determine the presence and nature of the hybrids present.

In WP4 we will develop methods for the rapid detection of invasive fungi and oomycetes. This involves detection of such pathogens when associated with plants during international trade (focused on baiting assays for *Phytophthora* species) as well as detecting long distance aerial spread of fungal spores. The latter will involve testing of inexpensive spore traps in combination with state-of-the-art molecular techniques. The objective is to determine the feasibility of a network of aerial spore traps.

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3. Methodology
In WP3 a first method to detect the hybrids will be via flow cytometry, in which the genome size of the candidate hybrids will be determined and compared with those of non-hybrid species. This will also allow detection of genome size fluctuations in unstable hybrids. A second method to detect the hybrids will be genotyping by sequencing (GBS). This is a "complexity reduction" technique in which the sequence of DNA fragments flanking restriction sites is determined using a next generation sequencing (NGS) technique. In combination with data from non-hybrid reference species this must allow us to identify hybrids and their parental species. These identifications will be applied to isolates from culture collections as well as to newly collected isolates.

In WP4 we will capture aerial spores using three spore samplers (Burkard, rotorod, filters). We will focus on filter samplers, as their simplicity and affordability would allow their deployment over a large area. In combination with DNA extraction and an NGS technique (amplicon sequencing of the rDNA ITS region) this should allow identification of most fungal spores that were sampled to species level.

4. Nature of the interdisciplinarity
The RESIPATH project contains aspects from several disciplines: ecology, forestry, horticulture, mycology, phytopathology, molecular biology and social sciences.

5. Potential impact of the research on science, society and/or government decision making support
Application of the flow cytometry and NGS techniques for the detection and characterization of (invasive) fungal species is novel and can have a substantial scientific impact. The obtained methods and results can contribute to the faster detection of invasive pathogens and to a better assessment of the risks of such pathogens. Both can support government decision making.

6. Description of the final research results (model, scenario, report, workshop, publication, etc.) in the short and middle-long term
The research results will be communicated to the public via reports and via scientific papers.

CONTACT INFORMATION

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LINKS

The project is described in general terms on the website of the international project coordinator (SLU in Uppsala, Sweden).
http://www.slu.se/en/departments/forest-mycology-plantpathology/resipath/