



Ecology of plant-parasitic nematode communities to better manage the invasion risk of *Meloidogyne chitwoodi* and *M. fallax* in France

Nathan Garcia



Co-funding

ANSES / Région Bretagne

2014-2017



UMR IGEPP

Institute for Genetics, Environment and Plant Protection

INRA - Agrocampus Ouest - Université de Rennes 1

Team

Resistance and Adaptation

Co-direction

Eric Grenier (INRA)
Laurent Folcher (ANSES)

Partners

ANSES
Région Bretagne



Keywords

Quarantine nematodes

Agroecology

Interspecific competition

Assessment of risk invasion

Nematode communities structure



Social-economic context

Plant-parasitic nematodes (PPN) are microscopic rounded worms that feed on the plant tissues and can induce important damages. It is estimated that PPN are responsible for a worldwide loss of 80\$ billion per year. Two of the 10 major PPN are *Meloidogyne chitwoodi* and *M. fallax* which can induce severe damages on most of the root crops (such as potato, carrot or beet). In France, they are considered as invasive species and thus highly regulated. One of the current major challenges facing agriculture is to reconcile quality and quantity of productions on the one hand and health of consumers and ecosystems on the other. In the frame of the Ecophyto program it is for example expected to study and exploit biotic interactions in their entirety in order to develop novel management means.



Scientific context

Nematode communities have been described during the past decades, but their structure and functioning are poorly known in agrosystems. More precisely, it is important to understand how the agricultural practices (tillage, crop rotations, use of pesticides ...) and the soil conditions (pH, organic matter abundance, type of soil ...) can impact the nematode communities to be able to propose clues to deal with those pests. Moreover, biotic interactions must also be understood to propose novel management means existing at the community level. This is not only to describe the species assemblages present at a given spatial scale but also to answer a number of questions related to the species interactions within communities. Even if *M. chitwoodi* and *M. fallax* are well characterized in the scientific literature, few studies have focused on the interactions between those pests and the other PPN.

Objectives

In this PhD project we will apply a community ecology approach to understand the organization mechanisms of biological communities. For that, one of the objectives is to describe the PPN communities in agrosystems and to evaluate the

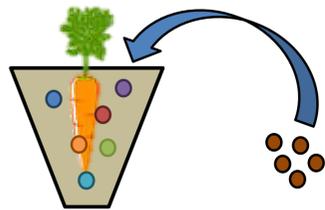


impacts of the cultural practices and soil conditions on the structure and functioning of those communities. Several field sampling will be done, two years consecutively, in various French geographical regions, under various agricultural managements. Following the identification of the PPN, we will be able to do some statistical comparisons between the PPN communities. The strategy is to

develop R scripts to analyze the communities with descriptive statistics (such as MCA) and test the highlighted relations with GLM.

To push further the community description, we will analyze the intra-specific genetic diversity of some PPN, in order to evaluate if the species richness in each community can alter the genetic diversity (and reciprocally)

Ultimately, we will work in confined laboratory to make competition experiments between *M. chitwoodi* or *M. fallax* and various PPN communities or a specific damaging PPN. The aim here will be to determine if the local PPN are able to prevent or slow down the installation of the two invasive species.



Results

To date, the first sampling campaign in nine regions of France has permitted the identification of eleven PPN genera (and sometimes also species in these genera). Statistical analyses have been conducted on a previous dataset and have highlighted the impact of the tillage and the use of pesticide on the abundance of the PPN. We also showed that communities are not always conserved from one year to another suggesting a strong impact of the recent practices and/or of climate on some PPN genera.

In anticipation of the competition experiments, nematodes are currently rearing in laboratory from an agricultural soil in different host plants in order to modulate the community composition.

Perspectives

Despite the enhancement of the knowledge in PPN community ecology, particularly in agrosystems, this study should help us to improve agricultural managements to avoid damages from PPN on given crops. It should also highlights some local PPN communities more sensible or resistant to the introduction of *M. chitwoodi* and *M. fallax*.

