Impact of intercropping on biodiversity and adaptive dynamics in plant pathogens complexes

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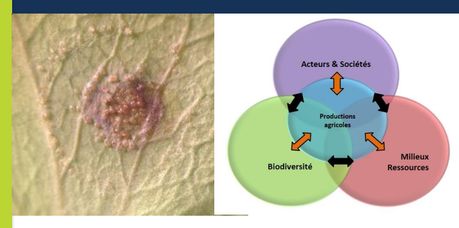

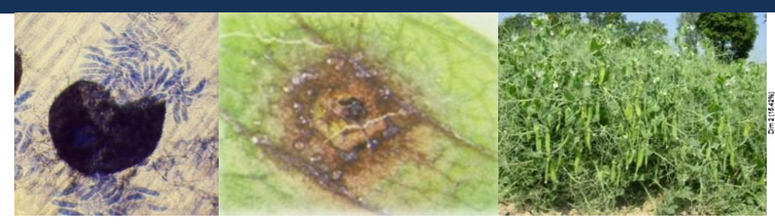

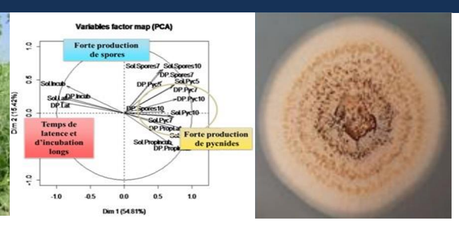

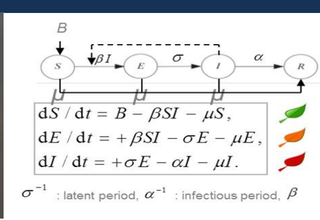

Social-economic context

Crops are subject to many problems linked to pathogens, their management is primarily based on the use of pesticides. However, the negatives effects of these products on human health and the environment, as well as the appearance of resistance, question the durability of conventional agricultural systems. Therefore, new agricultural practices, which would provide more ecosystem services, are under consideration. Among these, this study will focus on field diversification through intercropping, which enable control of plant diseases.

Scientific context

This PhD project will focus on the potential impact of a pea-wheat intercropping system on the Ascochyta blight complex (*Didymella pinodes (Dp)* and *Phoma medicaginis* var. *pinodella (Pm)*) adaptive dynamics. The basic assumption of this study is that intercrops will contribute to develop a greater diversity of ecological niches, which in turn will select specific components of the disease complex according to the life history traits (LHT) of complex member species. To date, no study linked the impact of intercrops on a plant pathogen adaptive dynamics to the LHT and trade-offs between these LHT.

Objectives

The aim of this study is to analyze the adaptive dynamic of a plant pathogen complex in a pea-wheat intercrops using experimental and modelling approaches. This objective is based on two questions:

(1) Which LHT and trade-offs between these LHT will more affect the exploitation and colonization of the different ecological niches?

(2) Does diversity of ecological niches within intercropping system select fungal species with particular LHT, thus modify the composition of the plant pathogen complex?

Results

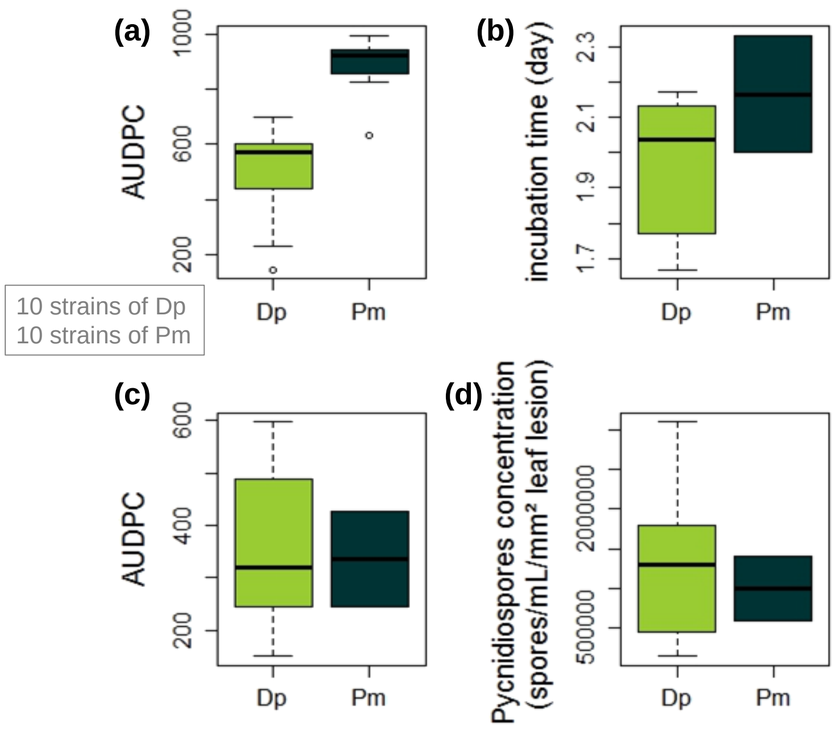

Figure 1: Comparison of four life history traits of the two complex member species *Didymella pinodes* (Dp) and *Phoma medicaginis* var. *pinodella* (Pm): (a) mycelial growth on malt agar culture medium, (b) incubation time (time between inoculation and the appearance of the 1st symptoms), (c) leaf lesion expansion, (d) pycnidiospores concentration per area of leaf lesion. AUDPC: Area Under the Disease Progress Curve (according to Bourgouin 2013).

To address these questions, the first step is to determine in controlled conditions the intra and interspecific level of variability of LHT and their respective trade-offs.

In this preliminary study, saprophytic traits (mycelial growth) and parasitic traits (incubation, aggressiveness, and offspring production) were assessed for both pathogenic species (**Fig. 1**). Results highlight an interspecific but also intraspecific variability for the different LHT studied. On average, Dp have a lower saprophytic development as Pm (**Fig. 1A**), but its parasitic capacity is higher (**Fig. 1B, C, D**).

Perspectives

The fungal species show different environmental exploitation strategies, which could lead to ecological niche partitioning. The next step is to assess the LHT of a wide range of pathogenic species in controlled conditions, and then, in pea-wheat intercrops, to analyze the epidemic development and ecological niches diversity.