

POGRIVE

To know, understand and adapt to *Polymyxa graminis*, a virus vector on tropical and temperate cereals

ABSTRACT

Polymyxa graminis (Pg) is an endoparasitic protist of plant roots belonging to the order Plasmodiophorids. This parasite does not cause symptoms in infected plants but is a vector of four genera of phytoviruses that can cause important damage to several major crops including temperate and tropical cereals.

Environmental conditions (temperature and rainfall) play a crucial role in the biological cycle of Pg (multiplication and spread). In France, wet / warm autumns followed by cold winters have been suggested to favor mosaic diseases on durum wheat and barley. In other countries of Latin America and Africa, re/emergence of a Pg-borne viral disease was recently observed on rice without identified causal factors.

Despite the impact of viral diseases and the description of several Pg types, the biology, diversity and specificity of vector/virus interactions remain largely unknown. This knowledge gap hinders the identification of efficient and durable solutions.

Pg survives for many years in infested soils in the form of highly resistant sporosores. Chemical control by soil treatment is neither efficient nor acceptable for economic and ecological reasons. Early detection and prophylactic recommendations would help to prevent or at least to slow down the disease contamination linked to agricultural practices. In addition, the identification of climatic risk factors would contribute to support farmer decision-making for crop rotation or varietal choice. Resistant varieties of durum wheat and rice are not yet deployed. Sources of resistance have been identified but the complexity of the Pg mediated transmission slows down phenotyping, screening and selection of cereal varieties.

The POGRIVE project labelled by KIM RIVE aims to know, understand and adapt to Pg using interdisciplinary and multiscale approach (from Occitanie to Africa). Based on strong preliminary experiments and complementary expertises on the vector, the viruses and their hosts, our consortium gathers researchers from 2 units of Labex Agro (PHIM, AGAP), international academic partners from UCLouvain (Belgium), INTA (Argentina) and INERA (Burkina Faso) and partners from private agricultural sector Arvalis (Institut Technique du Végétal).

The POGRIVE project will address the following questions :

What are the impacts of agro-climatic parameters on Pg biodiversity ?

- What are the impacts of plant host biodiversity on Pg biodiversity ?
- What are the impacts of Pg biodiversity on viral vection ?
- What are the impacts of agro-climatic parameters on viral vection ?
- What are the impacts of plant host on viral vection ?

The POGRIVE project will provide both fundamental data (first complete genomic sequences of Pg from durum wheat and rice, biodiversity collection, biological properties, host range and vection ability) and applied deliverables (specific detection tools, epidemiological surveillance database, climatic risk factors, resistance phenotyping assays). Based on these expected outputs, the POGRIVE consortium aims to co-build a larger european/international research project for 2024.

Keywords : Protist, Diversity, Virus, Vection, Agro-climatic parameters, Rice, Durum, Wheat, France, Argentina, Burkina-Faso

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Project type : AAP

Research units in the network :

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Flagship project : no

Project leader : Eugénie Hébrard

Project leader's institution : IRD

Project leader's RU : PHIM AGAP

Budget allocated : 190000 €

Total budget allocated (including co-financing) : 190000 €

Funding : Labex

GOAL

Compared to other protists, fundamental data on biology of Pg are still scarce and this biological model can be considered as orphan due to its complexity. Faced to this challenge, the project POGRIVE built an international research consortium which gathered complementary and interdisciplinary expertises on protist, virus and cereals.

The general objective of the project POGRIVE is to improve our knowledge of the Pg vector and the transmission of associated viral diseases on cereals, by examining (i) the environmental conditions that favor Pg multiplication and viral transmission, (ii) the biodiversity of these temperate and tropical pathosystems and (iii) the biological specificities of plant/virus/vector interactions.

A better knowledge of these pathosystems is the first step towards the modeling of the infection risks in relation with agro-ecosystem biodiversity and weather forecasting and the identification of durable cultural practices to reduce the disease pressure or its impact.

ACTION

WP1: Ecology and spatio-temporal distribution of P. graminis and cereal viruses

WP2: Biodiversity of P. graminis and of viruses transmitted by Pg

WP3: specificity of the host/vector/virus interaction in controlled conditions