IPM Blight 2.0: using pathogen population information to improve late blight control

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project coordinator
on behalf of all project partners
Phytophthora infestans on potato

• A destructive...
  – Strong defoliation
  – Fast epidemics
  – Over 900 M€ annual cost in Europe

• ... and re-emerging pathogen
Genotype diversity and distribution in Europe
Rapid changes in clones
Clone diversity: between and within
Understanding population changes

Problem 1: Genotypes may not predict phenotypes
Understanding population changes

**Problem 2:** All clones do not respond equally to climate
One good news: the nastiest ones do not (always) win
Open issues

• We can quite accurately describe and explain past changes...
• ... and we can follow current evolutions...

• But:
  – we still have a hard time predicting future changes
    • > when will the next change occur?
    • > who is going to be the next invader?
    • > What are the key traits behind invasive success and/or lasting presence in populations?

  – Population data are ignored in current DSS
The needs – EuroBlight Statement – 2015, Brasov

Recommendations:

Monitoring of the meta population of P. infestans in Europe and beyond

Linking genotypes to phenotypes

EuroBlight engages in the development and improvement of DSS adapted to IPM2.0

Fostering international collaboration
An answer: IPMBlight2.0

IPM2.0 for sustainable control of potato late blight - exploiting pathogen population data for optimized Decisions Support Systems

WP 1 – sampling and genotyping *P. infestans* populations

WP 2 – phenotyping *P. infestans*

WP 3 – developing improved LB DSS – IPM 2.0

WP 0 – coordinating and disseminating IPMBlight 2.0

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**WP 0 – coordinating and disseminating IPMBlight 2.0**

- Website
- New DSS simulation models/ modules
- Existing DSS improved and tested
- Stakeholder interaction

**WP 1 – sampling and genotyping *P. infestans* populations**

- Isolate sampling & Reference isolate collections
- Genetic (SSR) fingerprints
- Aggregated data on individual isolates

**WP 2 – phenotyping *P. infestans***

- Virulence
- Fungicide resistance testing
- Field trap nurseries

**WP 3 – developing improved LB DSS – IPM 2.0**

- Aggressiveness
- Potato Late Blight Toolbox
- Data management and analytic tools (e.g. poppr)

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**An answer: IPMBlight2.0**

IPM2.0 for sustainable control of potato late blight - exploiting pathogen population data for optimized Decisions Support Systems

C-IPM

Coordinated Integrated Pest Management in Europe
IPMBlight 2.0 – partners
IPMBlight 2.0 – deliverables and communication

• **New knowledge**
  • Population structures
    Population phenotypes and variability
    Phenotype x genotype connections
  
  • Methods and protocols

• **Operational tools**
  • New/improved open DSS modules
  
  • Network of reference labs for efficient epidemiovigilance (connected to Euroblight)
What have we done already?

WP 0 – coordinating and disseminating IPMBlight 2.0

- Advisory Board appointed
- Contracts signed
- Web meeting room
- Project announced

WP 1 – sampling and genotyping P. infestans populations

- 2016 collection established
- 2016 isolates genotyped
- Data upload started

WP 2 – phenotyping P. infestans

- Isolate sampling & Reference isolate collections
- Virulence
- Agressiveness
- Fungicide resistance
- Field trap nurseries
- Genetic (SSR) fingerprints
- New DSS simulation models/ modules
- Presentations prepared for Euroblight 2017 workshop

WP 3 – developing improved LB DSS – IPM 2.0

- Aggregated data on individual isolates
- Stakeholder interaction
- Papers and conference presentations
- DSS modules inventory
- Trap nurseries established
- Phenotyping 2016 collection underway
- R set OK
- Test methods agreed

Website

Potato Late Blight Toolbox

Data management and analytic tools (e.g. poppr)

Outlines for 3 papers drafted

Advisory Board
First achievements

• **Population structures**
  > emergence of 36_A2, 37_A2 and 38_A1
    • Talk D Cooke
    • Poster R Corbière et al

• **Pathogen phenotypes**
  • Fungicide sensitivity
    • Talk Britt Puidet et al
  • Agressiveness
‘Hunting the new’:
First hints on 37_A2 aggressiveness
Early conclusions...

• ‘Hunting the new’ ...
  • Infrastructures
  • Fast reaction
    ➢ value of an EU wide (and global) epidemiovigilance scheme

• ... knowing the old
  • Large subclonal variation
  • Genotypes alone do not predict everything right

• Network strength
  • Population surveys
    • Sampling
    • Databases
  • Complementary expertises
    • Protocols
... and questions still pending

- **From population knowledge to improved control?**
  - Proof of concept still to be made
  - Integration in DSS underway

- **Faster phenotyping?**
  - Is important
  - How to do it best?

- **How much will global change jeopardize LB control?**
  - Better characterisation of climate response needed
  - Will cultivars select as much/more than did fungicides
  - One world, one health
    - Time to get LB research global?
IPMBLIGHT2.0

Late blight, caused by Phytophthora infestans, remains the major threat to potato crops in Europe, and a main reason for pesticide use. Despite the release of resistant cultivars and the implementation of modern DSS operated from web platforms or mobile apps, integrated management of late blight still relies heavily on many fungicide applications (up to 25 per season in some regions). The need is thus to develop strategies that take full advantage of alternative options for more sustainable crop protection and better fungicide stewardship. To be sustainable and adopted, such strategies must be tailored to the variability of P. infestans populations and their rapid evolution - the IPM 2.0 concept. This in turn supposes that pathogen populations be monitored for both genotypes and phenotypes, including virulence, aggressiveness and fungicide sensitivity.

IPMBlight 2.0 aims at validating the IPM 2.0 concept, with potato late blight as a case study. To this end, it will use genotypic (WP1) and phenotypic (WP2) collections of the pathogen and populations collected while adjusting existing ones to offer risk and weather-driven infection likelihood and pathogen population assessments. The outcome will therefore be able to best inform tactical choices and potentially result in strategic decisions (Can I trust this resistant cultivar? How long will it last?) for improved late blight control.

The project will establish a unique database within EuroBlight, and complements them by gathering genotypic and phenotypic data. EuroBlight is a large collaborative network of biotechnology industries, DSS developers and extension specialists dedicated to potato late blight, which has been active for over 20 years. IPMBlight 2.0 will use the IT platform to establish genotypic and phenotypic data and analyses on pathogen evolution, improved open-source DSS models and to establish a reference network of laboratories able to track new emergences within European P. infestans populations. Through its international links, IPMBlight 2.0 will also provide updated information regarding the connections between European and global populations of the late blight pathogen.