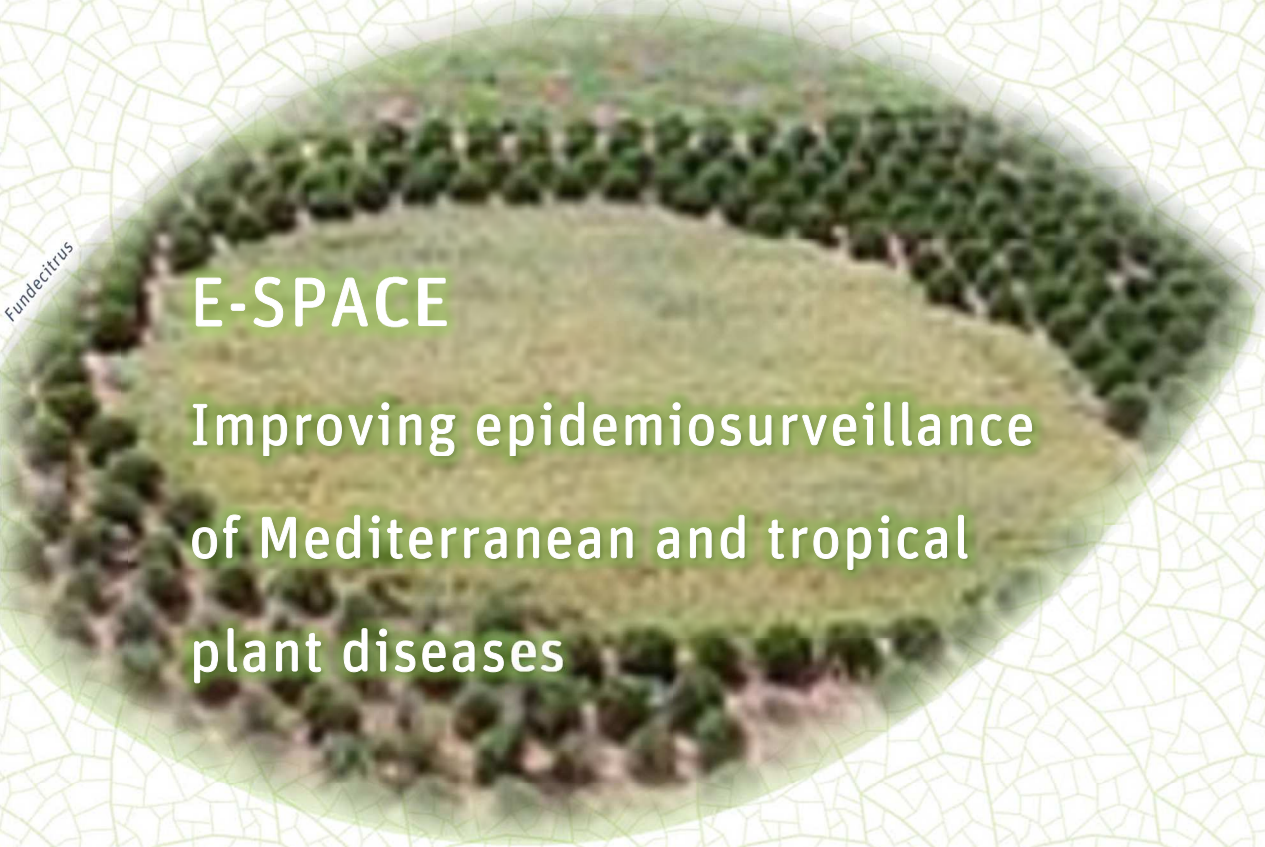
FLAGSHIP
PROGRAMMES



Fundecitrus

E-SPACE

Improving epidemiosurveillance of Mediterranean and tropical plant diseases

Damages caused by emerging, re-emerging and chronic/endemic pathogens pose increasing risks of economic losses to plant productions. Among these pathogens, emerging pathogens have dramatically impacted agricultural yields over the past 50 years. For example, the recent and rapid (30 years) world-wide emergence of black leaf streak disease (BLSD) of banana, the rice blast disease and the recent emergence of cassava mosaic disease in sub-Saharan Africa are considered as 3 of the 7 main plant diseases threatening the world food security. The annual economic loss due to rice blast has been estimated at US$66 billion.

This flagship program aims at building synergies between existing initiatives and at setting new innovative approaches in order to improve our knowledge of pathological and epidemiological processes underlying plant pathogen emergence. The ultimate goal is to provide plant epidemiosurveillance programs with key-data and key-tools for continuously adapting them to the evolving challenges of emerging plant diseases.

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CONTEXT

Threats by plant pathogens are increasing as a result of globalization, human mobility, climate change, and pathogen or vector evolution.

Rice blast disease (© Cirad)

Epidemiosurveillance networks are essential for crop protection against major chronic/endemic and emerging diseases. Several epidemiosurveillance networks have already been established at national and global scales. In France, these networks rely on field observations, samples analyses and/or meteorological data, and they aim to assess the risk of disease outbreaks. For instance, a tropical epidemic vigilance network and a Mediterranean epidemic surveillance network have been set up to detect as early as possible the introduction of BLSD in Martinique and Guadeloupe or to identify and remove sharka-infected *Prunus* trees throughout France. At a regional scale, the surveillance program on rice diseases relies on data collected by research partners or during scientific surveys and sample analyses are performed in an international laboratory (LMI Patho-Bios) based in Burkina Faso. These epidemiosurveillance networks mobilize different professional partners including field observers, reference or research laboratories, and technical organizations and require multiple data sources (e.g. geographical, environmental, genomic) and tools (e.g. diagnosis, strain typing, bioinformatics). But, contrary to well-known surveillance networks operating on human and animal pathogens, most plant surveillance networks have been set up on a very heuristic basis.

CHALLENGE

Clearly, the ever-increasing risks of disease emergence call for an improvement of the conceptualization and practical setting up of epidemiosurveillance strategies.

Surveillance efficiency critically depends on a fine timing of the network characteristics (i.e. the spatial and temporal distribution of monitoring effort) to the biological processes at work. For example, the network architecture should take into account the dispersal abilities of the pathogens and vectors, their levels of specialization, their adaptive potential, as well as the biotic and abiotic characteristics of the monitored agro-ecosystem. Besides generating up-to-date knowledge about the epidemiological status of a disease (e.g. spatiotemporal incidence of the disease, economic losses), the use of multi-disciplinary upstream approaches will help understanding the emergence of new diseases or the spread of known ones and develop strategies to manage them. These approaches will also help monitoring pathogen evolution, so as to allow professional partners to decide which management strategy is the most appropriate (e.g. eradication, prevention, coping).

« Most of the considered pathogens affect sustainable crops or economically important plants for developing countries. A better understanding of disease emergence is expected to produce applicable advice to control pathogens ».

Claire Neema - BGPI
Project leader

OBJECTIVE

Improving epidemiosurveillance strategies requires research dedicated to providing the biological knowledge necessary for network conceptualization, finding innovative ways to conduct epidemiosurveillance, and efficient and real-time transfer to professional partners.

This flagship program aims at improving the knowledge of pathological and epidemiological processes underlying plant disease emergence, and designing innovative approaches for monitoring early warning and crop protection. It will provide national and regional plant epidemiosurveillance programs with key -data and key -tools for continuously adapting them to the evolving challenges of emerging plant diseases.

ORIGINALITY

The main originality of this project lies on :

- the global analysis of more than 30 pathosystems, which give the unique opportunity to assemble comparable data and to identify trends and patterns associated with the emergence of some of the most devastating plant pathogens.
- the development and use of up-to-date powerful molecular methods (e.g. metagenomics) and analytical tools (e.g. statistical inference of emergence or key epidemiological parameters) for epidemiosurveillance,
- the exploration of ecosystems that have been sustainably unaffected by diseases
- the setting up and application of a work-package dedicated to transferring tools and knowledge to partners.

Field-based training session

ACTIONS PLANNED

- Understanding bioinvasion pathways
- Understanding epidemiological dynamics and adaptive changes underlying the emergence of plant diseases
- Understanding biotic factors associated with the non-emergence or emergence of pathogens

KEYWORDS

Epidemiosurveillance
Pathosystems
Metagenomics
Molecular methods
Statistical inference
Analytical tools

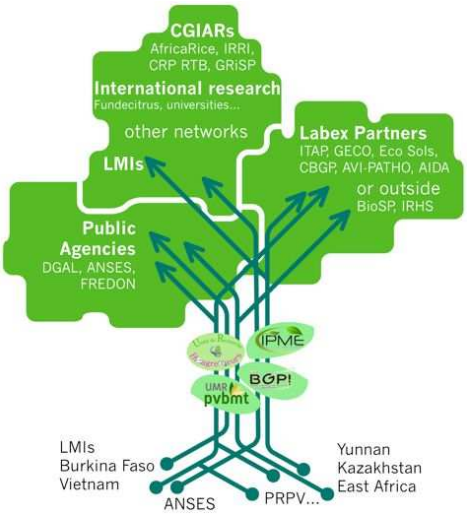
EXPECTED OUTPUTS

- Reinforcement of the functional links between epidemiosurveillance stakeholders
- Two trial sites dedicated to rice epidemiosurveillance
- Transfer of new tools and protocols for epidemiosurveillance
- Development of epidemiological and evolutionary models and associated software
- Transfer of collaborative tools and data to the different stakeholders and partners through technical and scientific training sessions and meetings
- Construction of a website dedicated to E-SPACE : a scientific network dedicated to the Epidemio-Surveillance of PAthogens on Crops and their Environment

CONSORTIUM

Four research units of the "Labex Agro" are leading this flagship program :

- Biologie et Génétique des Interactions Plante-Parasite (BGPI)
- Interactions plantes-microorganismes-environnement (IPME)
- Peuplements Végétaux et Bioagresseurs en Milieu Tropical (PVBMT)
- Bioagresseurs



ABOUT US

Agropolis Fondation's mission is to support and promote high-level research and higher education in agricultural sciences, with a focus on sustainability in temperate, tropical and Mediterranean regions. As a foundation for scientific cooperation, it supports cutting-edge science that is responsive to critical development challenges through an interdisciplinary and integrated approach to plant research. Working with about 400 partners overseas, its network of 37 research units in and around Montpellier specializes in plant research at various levels- from its genes to its environments to its final uses and societal issues.

Its thematic areas of interest are the following:

- Genetics and genomics, plant breeding, ecophysiology
- Plant pathology, integrated crop protection, population ecology
- Agro-ecosystems, crop production, resource management, agroecology
- Food processing and transformation
- Social management of innovation; agriculture – society interaction

From its base in Montpellier, at the heart of Agropolis, the Foundation is able to draw on an extraordinary pool of international expertise and talent.

ABOUT FLAGSHIP PROGRAMS

Flagship Programs (FP) are comprehensive initiatives of Agropolis Fondation that are of scientific and strategic importance. These programs tackle major global issus, are at the interface of various disciplines or focus on addressing multi-disciplinary and development-oriented research topics.

These initiatives demonstrate the degree and extent by which the know-how, expertise and competencies of the various research units comprising the Foundation's scientific network and their partners are mobilized and put into use in order to contribute in addressing major challenges of our time.

HOW WE CAN WORK TOGETHER ?

While we have the facilities and equipment - from experimental sites to technological platforms - and a unique pool of expertise, the challenge far outweighs our current means.

We seek to establish partnerships with those keen on exploring with us solutions to the world's food, agriculture and biodiversity challenges. We are convinced that joining forces will result in a better synergy of efforts in promoting scientific excellence and relevance while maximizing development impact.

We invite you to explore with us creative means of supporting and complementing our respective efforts in seeking sustainable solutions to fundamental questions through innovative research and capacity building.

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