



The impact of global change on the emergence of plant diseases and pests in Europe

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#2018GlobalChange

Editorial

Global climate change is the result not just of human activities, but also of changes in society itself, the intensification of global trade and changes in agricultural production systems. In this last field, changes to public policies in France as well as in other European countries tend to favour an environmentally-friendly approach, in parallel with a reduction in chemical inputs. These agro-ecological approaches can potentially cause the emergence of different types of plant diseases and pests than those related to artificial and intensive agricultural production systems. We need to be able to foresee this and incorporate it into management systems for both agricultural production and non-agricultural areas, in fact for the environment as a whole.

Against this background, ANSES, EFSA and EPPO are together organising a conference on this particular topic, the impact of global change on the emergence of plant diseases and pests in Europe.

The conference aims to bring together researchers, public decision-makers and all stakeholders in the field of the environment and agricultural production, in order to take stock of this issue and enable avenues of discussion to emerge on how best to assess and manage the risks to plant health with which we are likely to be confronted in the years to come.

Session 1 – Impacts of the globalisation of trade and human migration on the emergence of plant diseases and pests

Moderator

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BIOGRAPHY

Géraldine Anthoine, the interim head of the ANSES – Plant Health Laboratory, coordinates the analytical activities and the quality management systems of the laboratory, which she represents in regional (EPPO) and international panels (IPPC-TPDP) according to her expertise related to nematology.



Impact of Globalization on Plant Health and the IPPC Strategies

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BIOGRAPHY

Dr. Jingyuan Xia has been the Secretary to the FAO-based International Plant Protection Convention (IPPC) in Rome since 2015. His experience includes work as Permanent Representative and Ambassador of the China Mission to UN Agencies (CNAFUN) in Rome, Italy (2012-2014); Director General of the National Agro-tech Extension and Service Center (NATESC) of the Chinese Ministry of Agriculture (MOA) in Beijing, China (2001-2011); and Director General, Deputy Director General and Assistant Director General of the China Cotton Research Institute (CCRI) at the Chinese Academy of Agricultural Sciences (CAAS) in Anyang, China (1993-2000).

Dr. Xia holds a BSc in Plant Protection at the Central-China Agricultural University in Wuhan (China), an MSc in Entomology at the University of the Philippines at Los Banos (UPLB) and the International Rice Research Institute (IRRI) in the Philippines, and a PhD in Production Ecology at the Wageningen Agricultural University (WAU) in the Netherlands.

ABSTRACT

The International Plant Protection Convention (IPPC) is the plant health multilateral treaty, which was established in 1952, and hosted by the Food and Agriculture Organization (FAO) of the United Nations. The mission of the IPPC is to secure coordinated and effective actions to prevent and to control the introduction and spread of pests of plants.

Within a given ecosystem, co-evolution between host plants and pathogens is a stepwise reciprocal evolutionary interaction, by which epidemics result in intense selection pressures on both host and pathogen populations, ultimately allowing long-term persistence and ecosystem stability. The world's plants and pathogens have evolved in unique regional assemblages, largely isolated from other assemblages because of geographical barriers. When geographical barriers are broken, non-indigenous pathogenic organisms are introduced into new environments, where they may find suitable hosts lacking resistance genes and environments favouring their pathogenic behaviour; this process may result in epidemics of newly emerging diseases. Biological invasions are tightly linked to human activities and have, therefore, been a constant feature of most of human history. Pathogens have several pathways of entry into new environments, the great majority of which are human mediated.

The fossil record provides evidence that diseases commonly affected plants some 250 million years ago. In the last 200 years the incidence of diseases affecting plants has increased exponentially in terms of both numbers and severity. Most of newly emerging plant diseases arose following the introduction of exotic pathogens into a new environment. Diseases caused by fungi and fungus-like organisms are of increasing importance among plants over the last 15 years. Moreover, an exponential increase in invasive forest pathogens in Europe over the last 30 years is evident. The introduction of alien pathogens can lead to novel host-pathogen associations or indeed novel pathogen-pathogen combinations, for which there is no previous co-evolutionary history.

Technological developments have facilitated trade in goods, and a consequent transport of pathogens. Historical geopolitics and regulation of trade have influenced the establishment of pathogens in different world regions. Here we provide an analysis of this phenomenon focusing on the means of introduction of these organisms, which generally can be attributed to technological developments, human behaviour and government policies.

Developing an in depth understanding of the historical context of these invasions could reduce the rate of future invasions leading to significant impacts on economics, ecology and on human health and wellbeing.

Emergence of wheat blast in India and Bangladesh: an increasing risk for Europe?

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BIOGRAPHY

Didier Tharreau is a rice pathologist with 28 years' experience on the interaction between rice and *Magnaporthe oryzae* (syn. *Pyricularia oryzae*), the blast disease fungus. He is interested in the phylogeny and host specificity of *Magnaporthe*, the genetic and molecular determinants of interactions, the population diversity and structure of the pathogen at the worldwide scale, and the biology and genetics of sexual reproduction of *M. oryzae*. He developed international collaborations both in the North (in Europe, USA) and in Tropical areas (China, Madagascar, West Africa, and Latin America).

ABSTRACT

In Europe, wheat is the most widely planted food crop and the leading source of plant proteins in human food. In 2016, 62 M ha were planted and 250 M T were harvested in Europe (vs 220 M ha and 749 M T worldwide; source FAOSTAT). Wheat blast, caused by the fungus *Magnaporthe oryzae*, emerged and is a devastating disease of wheat in South America. It severely threatens wheat production in Brazil (30% yield loss in 2010) where the first outbreaks were reported 30 years ago (<http://blog.cimmyt.org/?p=3707>). In 2015, the disease emerged in Bangladesh (Islam et al. 2016) and spread the following year to India. Phylogenetic studies based on whole genome sequence clearly showed that this outbreak was due to an introduction from South America (Islam et al. 2016).

The origin of wheat pathogenic strains in South America is debated but experimental (Farman et al. 2017) and phylogenetic studies (Gladieux et al. 2017) support a host jump from *Lolium*. This genus encompasses a cultivated grass (*Lolium perenne*) but also common weeds. We recently identified *M. oryzae* as the causal agent of epidemics on cultivated *Lolium* in France (unpublished data). Non-scientific reports suggest that it is also present in neighboring countries.

The emergence of wheat blast in Europe would likely cause a large spread of the disease and major yield losses on this crop. There is an urgent need to 1) inform about the risk, 2) promote measures to prevent the introduction of the pathogen, 3) carry out research work to measure the risk (susceptibility of wheat varieties cultivated in Europe, presence of potential sources for host jump...), 4) develop surveillance methods and network, and 5) set up eradication plans to be used if the disease emerges.

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Recent introductions of *Xylella fastidiosa* in Europe

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BIOGRAPHY

Charles Manceau PhD. is a plant pathologist who conducted research on ecology and genetics of plant pathogenic bacteria at INRA for 30 years. He was the head of the Plant Pathology Unit (INRA-Agrocampus-ouest-University of Angers) from 2004 to 2012. He then joined ANSES, where he is the scientific director of plant health and the head of the Unit on risk assessment for plant health.

ABSTRACT

The first damage due to infection by *Xylella fastidiosa* was observed on vines in California in 1884, but the causal agent of Pierce's disease was only identified in 1978. This bacterial species has proven to be highly diverse, with a very broad range of hosts and a geographical distribution covering all of the Americas.