İMPACT OF CLIMATE CHANGE ON PLANT PESTS

Results and recommendations for the global plant health community

Maria Lodovica Gullino, Agroinnova - University of Torino May 4th, 2022



CLIMATE CHANGE INCREASES PEST RISKS GLOBALLY



A shift in warming and other climate and atmospheric conditions may result in direct or indirect effects on pests, including:

- changes in their geographical distribution;
- changes in seasonal phenology;
- changes in pest population dynamics.

A SCIENTIFIC REVIEW CARRIED OUT DURING THE IYPH

Introduction

- Effects of climate change on agriculture, forestry and ecosystems
- Global pests affecting crops, forestry and ecosystems
- Pathways used by pests
- Approaches used to investigate the effects of climate change on plant pests

Effects of climate change on plant pests

- Simulation of future pest risks
- Effects on individual pest species

Prevention, mitigation and adaptation

- Preventive measures
- Recent technological developments
- Mitigation and adaptation
- Conclusions and recommendations
 - Policy making and regulatory issues
 - Research required
 - International cooperation
 - Capacity building

Aims

- To asses the potential effects of climate change on plant pests and consequently to plant health.
- To provide information on:
- what has happened in the last decades;
- what is expected to happen in the next decade;
- what we can do in order to mitigate its impacts, to adapt to changing climates locally, regionally and globally.

Methodology adopted

Review of the best available literature.

Broad expertise, covering topics from plant pathology to entomology and climatology.

Participatory process, including a peer-review process.

Climate-change impacts on plant pests



09/02/2021

EFFECTS ON INDIVIDUAL PEST SPECIES

All important life-cycle stages of insect pests, pathogens, and weeds (survival, reproduction and dispersal) are more or less **directly** influenced by temperature, relative humidity, light quality or quantity, wind or any combination of these factors. The physiological processes of most pest species are particularly sensitive to temperature. **Indirect** effects are mediated through the host plant or through climate-change driven adaptations to crop management. Under warmer mean air temperatures, especially in early spring under temperate climatic conditions, life-cycle stages in the host plant may occur earlier.

This can affect pathogens that infect the host during a particular life-cycle stage.

CLIMATE CHANGE FACILITATES PEST DISPERSAL THROUGH NATURAL AND HUMAN MEDIATED PATHWAYS

- Pest dispersal occurs through natural and anthropogenic processes.
- The four T (trade, tourism, traffic, transportation).
- Wood, including wood packaging, as well as conveyances, cargo, agricultural equipment are instruments for passive pest movement.



PESTS CONSIDERED

Insect pests

- Emerald ash borer (*Agrilus* planipennis)
- Tephritid fruit flies (Global)
- Red palm weevil
 (Rhynchophorus ferrugineus)
- Fall armyworm (Spodoptera frugiperda)
- Desert locust (Schistocerca gregaria)

Plant diseases

- Coffee leaf rust (Hemileia vastatrix)
- Banana Fusarium wilt (*Fusarium* oxysporum f.sp. cubense)
- Xylella fastidiosa
- Oomycetes, including
 Phytophthora infestans and
 Plasmopara viticola
- Fungi producing mycotoxins

Nematodes

- Citrus lesion nematode (*Pratylenchus coffeae*)
- Soybean cyst nematode (Heterodera glycines)
- Pine wilt nematode
 (Bursaphelenchus xylophilus)

Weeds

- Butterfly bush (Buddleja davidii)
- Serrated tussock grass (Nassella trichotoma)



IMPACT OF CLIMATE CHANGE ON SELECTED PLANT DISEASES

Coffee rust (Hemileia vastatrix) A fungus, one of the main factors limiting arabica coffee yields worldwide.

Invasive range: Africa, Asia, Latin America

Its incubation period may be shortened by global warming, meaning more generations of the pathogen can develop over a growing season.



Banana Fusarium wilt (*Fusarium oxysporum* TR4) A soil-borne fungus.

<u>Invasive range</u>: Australia, Mozambique, Colombia, Asia, Near East

Temperatures over 34 °C and extreme events may increase the risk of banana Fusarium wilt, particularly when 'Cavendish' varieties grown in tropical climates are exposed to waterlogged soil.



EFFECT OF CLIMATE CHANGE ON FOOD SECURITY

Climate change may also threaten food security with

impacts on food crops and plant-based animal feed. For

wheat, rice and maize worst impacts are expected in the

tropics and subtropics.



RESULTS OF THE STUDY

- Climate change will result in increasing plant health problems in managed (e.g. agriculture, horticulture, forestry) and semimanaged (e.g. national parks) ecosystems, and presumably in unmanaged ecosystems as well.
- Adjustments in phytosanitary policies and plant protection strategies already necessary today, and even more crucial in the future.



PREVENTION AND MITIGATION

The most effective way to prevent and limit the international spread

of pests from trade and passenger movement is through:

- regulatory means;
- phytosanitary import legislation;
- pest and risk analysis;
- surveillance and monitoring;
- best management practices;
- information exchange.



RECOMMENDATIONS

- International cooperation
- International information exchange on trade flows,

pest occurrences and pest interceptions.

- Establishment of a global mechanism for research coordination
- **Multidisciplinary collaboration**, coordination and knowledge exchange in climate-change biology research



ACKNOWLEDGEMENTS

Thanks to FAO and to AGROINNOVA

