PROJECT FACTSHEET

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TWICE

Climate change and interactions between whiteflies, plants, parasitoids, and endosymbionts

INSPIRATION

Whiteflies are sap-sucking insects responsible for high losses in vegetable production. As they colonise our plants, they bring with them fierce plant viruses and damage hundreds of plant species. In many areas of the world, these damages lead to crop yield destruction and affect the food security of millions of people.
Ongoing climate change will impact these insects and organisms that surround them in ways that are currently poorly understood. As a result, sustainable control of whiteflies by the means of natural enemy release will also be impacted. Studying climate change is a challenge on its own, as it requires accurate prediction, followed by realistic physical simulation of future climate conditions. Going a step further and untangling interactions within a biological system where several organisms directly and indirectly affect each other under changing climate presents even bigger challenge.

INNOVATION

TWICE aims to shed light on how climate change will impact the whole system of whiteflies, their host plants, natural enemies and bacterial symbionts that live inside the whitefly's body. To do so, LIST will study this dynamic biological system by the means of climate simulation in a laboratory environment. Latest, regionally downscaled and physically consistent, climate prediction data will be used to program climate simulation chambers, which enable the accurate control of a wide panel of parameters (temperature, humidity, CO2 concentration, light, soil moisture etc.). Having both present and future climate conditions in the laboratory allows LIST researchers to perform realistic measurement of climate change impacts on organisms under study.
Parameters of whitefly reproduction and development will be measured as key predictors of their potential to cause severe damage to crops while monitoring of plant development will help understand how crops will perform in the future. Finally, LIST researchers will learn about future effectiveness of biocontrol methods by observing the performance of parasitoid natural enemies of whiteflies. However, these measurements tell only little about the underlying processes, which are needed for optimising current, and developing new control strategies. To get such mechanistic understanding, LIST will analyse the gene expression of plants and whiteflies in present and future climate with the help of next generation total RNA sequencing technology.

IMPACT

Building upon decades of metabolism research will allow TWICE to link the gene expression with their corresponding metabolic processes. As most recent statistical methods enable the identification of which processes are being modified by climate change, LIST researchers will not only give insights on the impacts of climate change on the metabolism of involved organisms individually, but also on interactions taking place between them.
TWICE will be the first project to apply realistic climate simulation to not only one organism, but to the system of organisms at different levels of the trophic pyramid and look at both effects and the causal processes. As a direct outcome, a detailed prediction of climate change impact on the very important global pest and on effectiveness of biological control methods in the future will be provided. This innovative project will also contribute to a better molecular understanding of plant and insect metabolic responses to current and future environmental conditions.
Finally, this knowledge will foster the development of new, sustainable whitefly control strategies, reducing the fundamental knowledge gap about climate change effects on whitefly threats, and moving LIST's whitefly research from establishment phase to innovative and applicable levels.

Partners
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