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Predicting whitefly population outbreaks in changing environments

Context

Both climate change and global trade are important drivers of changes in the abundance and distribution of insect pests. Whiteflies (Homoptera: Aleyrodidae) are important plant pests and virus vectors in many agricultural systems worldwide. Among them, the sweet potato whitefly, *Bemisia tabaci* (Gennadius) is considered the most devastating pest of vegetables, ornamentals and agronomic crops throughout the tropical and subtropical regions of the world because it can transmit more than 200 species of plant viruses. Previous distributions of the species were limited to regions between the 30th latitudes but over the past two decades it has invaded every continent in the world except Antarctica. Based on climate models, *B. tabaci* populations are expected to expand to regions where increasing temperatures will eliminate frosts, allowing year round breeding. Due to the extreme polyphagy of the species, the effects of such changes will probably be profound and may lead to substantial ecosystem-wide changes.

Objectives

Many arthropods host one or more inherited bacterial symbionts, the phenotypes of which have important implications for ecologically based pest management strategies. The overall goal of this proposal is to develop novel strategies for reducing the direct and indirect damage inflicted by *B. tabaci*. It aims to predict the evolution of *B. tabaci* populations around the Mediterranean, from which diagnostic and preventive measures can be derived.

Workplan

To achieve these goals the following objectives have been set: (i) determine the geographic distribution of *B. tabaci* biotypes, their population genetic structure and symbiotic complement around the Mediterranean basin in light of climatic changes; (ii) determine *B. tabaci* invasion routes within the Mediterranean basin; (iii) determine the respective influence of nuclear and symbiotic variations on stress resistance in *B. tabaci*; (iv) model the influence of climate change on *B. tabaci* biotype/population outbreaks; (v) establish a network of researchers. The research conducted involve the use of diverse methods including field studies, molecular biology, bioinformatics, analyses of international databases and advanced computer programs. In order to begin preparing now for the upcoming challenges of our changing environment, we will combine established research expertise in climate change assessment and environmental system modelling with insects and symbionts ecology, behaviour and population genetics for allowing the necessary incorporation of pest risk assessment and simulation models into comprehensive management planning systems of both natural and agricultural ecosystems.

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