Submission for Contributed Talk

A climate-driven epidemiological model for *Xylella fastidiosa* diseases

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Climate significantly influences the distribution and dynamics of agricultural pests and pathogens on a global scale. To effectively address emerging agricultural challenges amidst changing environmental conditions, it is imperative to comprehend the intricate relationships among climatic factors, pathosystem components, and subsequent epidemiological dynamics.

Among emerging pathogens *Xylella fastidiosa* (Xf) is considered one of the most dangerous phytopathogenic bacteria worldwide. It is naturally transmitted by xylem sap-feeding insects, such as sharpshooters and spittlebugs, and exhibits a broad host range that encompasses economically important crops such as grapevines, citrus, almonds and olive trees. Previous research has provided insights into the potential geographic range of some Xf diseases based on Species Distribution Models (SDM) applied to the pathosystem components (i.e. host, pathogen and vector). These models, however, do not yet provide the epidemiological niche of the disease but rather the ecological niche of their constituents. Plant disease epidemics are emergent phenomena resulting from non-linear interactions between pathosystem components, which, in turn, exhibit non-linear responses to changes in environmental variables. Thus, while climate primarily determines the potential geographic range of each organism in the pathosystem, the development of epidemic outbreaks depends on favourable host-pathogen-vector-climate interactions that drive transmission chains.

To solve this conundrum, here we develop a climate-driven epidemiological model for Pierce's Disease of grapevines, caused by *Xylella fastidiosa*. We show that the model is able to characterise the epidemiological niche of the disease and predict the risk of its establishment under current and future climate conditions. Our results show that the main wine-producing areas worldwide thrive mostly in non-risk, transient, or epidemic-risk zones with potentially low growth rates. Epidemic-risk zones with moderate to high growth rates are currently marginal outside the US. However, when incorporating the latest regional climate change projections for Europe, we found a significant increase in risk above +2ºC in the main wine-producing regions of France, Italy and Portugal, in addition to a critical point above +3ºC for the possible spread of PD beyond the Mediterranean basin.