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Impacts of climate change on the interactions between grapevine and two of its key pests: the European grapevine moth and powdery mildew

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Climate warming may alter current interactions and impact patterns of disease epidemics and pest attacks in more complex ways than we can imagine. In order to disentangle these effects, we need to improve our understanding of the host-pest/pathogen system, and consider their interactions. The aim of this study was two-fold: 1. combine detailed phenological models of grapevine with phenological models of one of its key insect pests (European grapevine moth) and one of its key pathogens (powdery mildew) 2. Apply the models to climate change scenarios for a selected study area (in the north-eastern Italian Alps), and consider potential changes in the interactions in these two pest/pathogen systems. We developed or validated phenological models for European grapevine moth, powdery mildew and grapevine cv. Chardonnay using data from the study area, then we applied them to climate change scenarios for two sites, considered representative of low altitude and high altitude viticulture. We combined simulated susceptible phenophases with pest/pathogen simulated phenology and considered changes in the interactions between host and pest/pathogen in terms of pest/disease pressure on grapevine for each site and scenario. These simulations suggested that in the warmer, more profitable viticultural areas of the study area increasing temperature might have a detrimental impact on crop yield due to increased asynchrony between the larvae-resistant phenophase of grapevine and larvae occurrence. On the other hand, the increase in pest pressure due to the increased number of generations could not be as severe as expected on the basis of the pest-model only, due to the advance in harvest dates limiting damages of late generations. Simulations for powdery mildew highlighted a decrease in simulated disease severity especially for sites that are currently exposed to lower disease pressure. Modelling studies aimed at predicting the impacts of climate in agricultural ecosystem change should integrate interactions between different trophic levels to obtain a more realistic picture of all potential effects and assist the development of more robust mitigation policies.