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Phenological models to predict plant-insect interactions under climate change scenarios: Towards a mismatch or an overlap?

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Plants and insects depend on climatic factors (temperature, solar radiation, precipitation, relative humidity and CO_2) for their development. Current knowledge suggests that climate change can affect plants and insects interactions. Indeed, in order to predict how species will evolve in the future and under climate change conditions, it is necessary to develop predictive phenological models. For plants, they characterize the evolution from budburst to maturity of the fruit. For insect pests, they allow representing developmental stages from lower to upper temperature thresholds.

Because of the economic importance of wine production, the interactions between grapevine, V. vinifera, L. botrana and Trichogramma spp. (an L. botrana egg parasitoid), are considered as a case study for addressing this specific issue.

Some phenological evolutions have already been observed in terms of speed of growth and geographical distribution according to latitude and altitude. The aim of our study is to implement a model that could be applied in order to quantify shifts in the timing and spatial distribution of hosts, pests and their natural enemies. With the integration of different climatic scenarios, one interesting issue would be to compare seasonality changes from the most optimistic to the most pessimistic one.

The predictions of future scenarios would determine the new zones at risk where climatic conditions will increase vulnerability and zones where risk could disappear. This study provides important information to develop insect pest management tools as for example, to optimize the treatments period or insect release for an optimal biocontrol using natural enemies.