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Assessing climate change impacts on fruit plant and pest phenology and their synchrony: the case of apple and codling moth

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Temperature is a main climatic driver of plant phenology and the dominant abiotic factor directly affecting insect pests. Global warming is therefore expected to accelerate the development of plants and insects. Moreover, in the case of multivoltine pest species higher temperatures are expected to lead to the appearance of additional generations toward the end of the warm season. These changes could entail higher pest pressure and hence require an adaptation of pest management, but ultimately this would depend on whether plant and pest phenology remain synchronized or not.

In this contribution we present an analysis of potential impacts of climate change on the phenology of the apple tree (Malus pumila L.), a fruit crop of economic relevance worldwide, and the codling moth (Cydia pomonella L.), one of its main pests. Key developmental stages of the apple and the codling moth were simulated by means of two heat summation models. The models were calibrated with lab and field data from Switzerland and subsequently run with observed weather data and various climate change scenarios. The time period between flowering termination and the harvest of the apples was compared to the appearance of the second and third generation of codling moth larvae to study the interlinkage between host and pest.

To illustrate the potential for practical applications of the phenology models, we used spatial temperature data of Switzerland to produce risk maps that can serve as a basis for further studies and decision support.