Insect Pest Management via physiologically structured population dynamics models with global climate change in mind

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May 3, 2016

With the phenomenon of global climate change had caused an explosion of insect pests and disease vectors that threaten bio-security. Crop vinyard industries are confronted with pest populations that cause great damage and losses. Chemical pesticides are normally used to control these pests. However, the adverse effects of these chemical pesticides, namely, high toxicity, residues in food, contamination of water and the environement resulting in human health hazard are becomming topics of growing public concern. In view of the above, there was a growing need to develop some alternative pest management strategies that are more environement-friendly. Viticulture is the art and science of growing grapes. Every detail matters and a great deal of attention has been paid to growing conditions, the differences between grape varieties, and protecting the plants from pests and diseases.

The European grapevine moth (Lobesia botrana) predisposing grape berries to infection by the grey mould fungus Botrytis cinerea, or also as the Scaphoideus titanus which is the invasive vector of the phytoplasma causing the Flavescence dore in European vineyards. These epidemics are a serious threat to viticulture that has been increasing for more than 60 years in Europe. Thus, it is necessary to improve current control techniques and to develop new control strategies.

We construct a multistage kinetic model of a physiologically structured insect population whose life history consists of fourth stages of development termed eggs, larval, pupal and moth adult (male and female). The model is a system of weakly coupled hyperbolic partial differential equations with nonlocal boundary conditions. The vital rates depend on the temperature and the resource which satisfy an ordinary differential equation. These models are numericallly discretised and numerical simulaions are peformed for monotoring different level of instect population present in the vineyard. We formulate optimal control problems with cost functionals related to real-life costs in the wine industry.Different kinds of senerio process to reduce pest population are performed via numerical simulations

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