Improving Insect-Pest Management via Mating Disruption and Trapping Models

Roumen Anguelov[1], Claire Dufourd[1,2], Yves Dumont[3]
[1] Department of Mathematics and Applied Mathematics, University of Pretoria, Pretoria, South Africa
roumen.anguelov@up.ac.za, claire.dufourd@up.ac.za
[2] DST-NRF Centre of Excellence in Mathematical and Statistical Sciences (CoE-MaSS)
[3] CIRAD, Umr AMAP, Montpellier, France
yves.dumont@cirad.fr

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Pests, such as the false codling moth, represent an important threat for food production in South Africa. Reducing the use of pesticides is a major challenge to meet specific export requirements and ensure economically viable crop production. Biological control, or pest-specific devices are often considered as alternatives to massive spraying of pesticides. The success of such methods often relies not only on a good knowledge of the pest biology and ecology, but also on a good understanding of the impact of the control device on the behaviour of the pest. In this context, we propose a mathematical model to study the impact of mating disruption and trapping on a pest population. First, we consider a temporal compartmental model given as a system of ODEs which takes into account the specific response of individuals to the control measures. Then, for more realistic modelling, the spatial component is taken into account leading to a model formulated as a system of advection-diffusion-reaction PDEs. Theoretical analysis allow to identify threshold values related to the effort of the control to ensure extinction of the pest population. Further, numerical simulations are carried out to validate the theoretical results and test different scenarios for a better understanding of the impact of the control on the pest population. These results are promising for the improvement of control devices and their use to obtain efficient management of pests in the crops.