A compartmental epidemiological model for brown rot spreading in fruit orchards

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Introduction

Brown rot, caused by *monilinia* spp., is one of the main fruits disease and it is responsible for important economic losses



Aim of present work:

- Develop a general mechanistic modelling framework for brown rot spreading
- Apply the model to a real study case (Prunus persica monilinia spp)
- Derive general guidelines for brown rot control in peach orchards

The model



Parm. Definition

Н	Healthy fruit
S	Latently inf. fruit
I	Infectious fruit
Х	Airborne inoculum
g(t)	Cracking rate
η	Disinfection rate
δ	Fruit abscission rate
λ	Infection rate
ρ	Sporulation rate
μ	Decay rate

Basic Reproduction Number

$$R_{0}(t) = \sqrt{\frac{g(t)}{\eta + \delta + g(t)} \frac{\lambda \rho H(t)}{\delta \mu}}$$

computed by the next generation matrix techniques (Diekmann et al. 1990)

Available data

An experimental peach orchard of 43 trees not treated with fungicide. 18 trees monitored every other week from 5th May (after thinning) until 31th July (before harvest):

- Fruit size
- Fruit status, i.e. symptomless (H+L) or infectious (I)
- Airborne pathogen density (X)





Parameter estimate and uncertainty (MC methods)

Model calibration and yield sensitivity to parameters uncertainty



Yield response to management practices

- Sanitation practices \rightarrow initial inoculum density X(0)
- Fruit thinning practices \rightarrow host density H(0) & cracking (α)



Next

- Quantify relationships between environmental conditions and model parameter values
- Analyze system behavior under different climatic scenarios