

Integrating phenology, trap models, and data to manage fruit fly risk

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Photo: CSIRO / AFP



Phenology modelling overview

- Empirical data to determine thresholds for development and survival
- Measured across different hosts
- Medfly has international models
- Qfly has had some attempts:
 - Code of Practice
 - Yonow et al. (2004) *Ecol Modelling* 173(1) 9-30





Current Challenges

- Limited transferability across all regions when Qfly occurs
- Assumptions
 - initial date of activity & overwintering
 - adult maturity and time to produce eggs again

WILEY



Merkel et al. 2019 J Appl. Entomol.





Phenology models

• A reliable phenology model allows for risk to be quantified:

40 30 20

10

- Orchard management
- Regional assessments
- Risk to market access
- Pathway to a better model:
 - Life history traits (lab) (ongoing)
 - Field-cage experiments
 - Data-mining?





Data and models at work

- Prototype app developed to explore data
- Open-source models and R packages
- Aim to integrate with new models and standards for reporting data
- Example: completely made-up orchard
 - Temperate fruit producer
 - Three traps on 14 ha







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👗 Flycetch? 👗

version 0.16

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Browse.

Upload Orchard Dataset

Select the Orchard

MadeUpLand



Weather data pulled in, calculates flight thresholds





Using models for management

- Orchard management
 - Timing of applying sprays and baits
 - Biofixes
- Overwinter (still poorly understood – host vs environment)









Trap Arrangement

- Optimise orchard trapping strategies
 - Traps per hectare
 - Traps at minimum distance from trees
- Early vs late season fly movement
- Aim to swap in different trap models
- Account for different trap types



Agriculture Victoria





TrapGrid

- Developed by USDA (Manoukis et al. 2015)
- Collaborating to improve upon
 - Calculating escape prob
 - Dispersal model

Species	1/lambda value
Ceratitis capitata (Medfly)	14m
Bactrocera dorsalis (Oriental fruit fly)	34m
Bactrocera tryoni (Qfly)	? 14-50m





Manoukis et al. 2015 Chemical Ecology















CSIRO objectives

- Putting data to best use
 - Trade as well as a Production problem
 - Industry partners and ongoing work
 - Systems Approach project
 - Aligning with CSIRO Missions
 - \circ Trusted Agrifood Exports



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