Modelling pathogen infection and spread in wheat canopies –
can it be applied to blackleg and Sclerotinia in canola?

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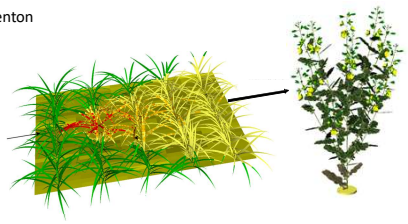
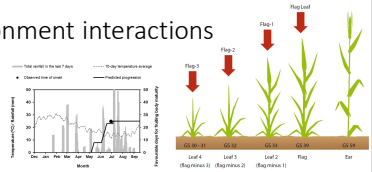


Host-pathogen-environment interactions

- Aim:
  - Improve understanding of **host-pathogen-environment interactions (H x P x E)** and their effect on crop yield using a modelling approach
- Including host structure
  - Dynamic plant development and growth at plant (sub)organ scale
- **A combined approach to model H x P x E?**



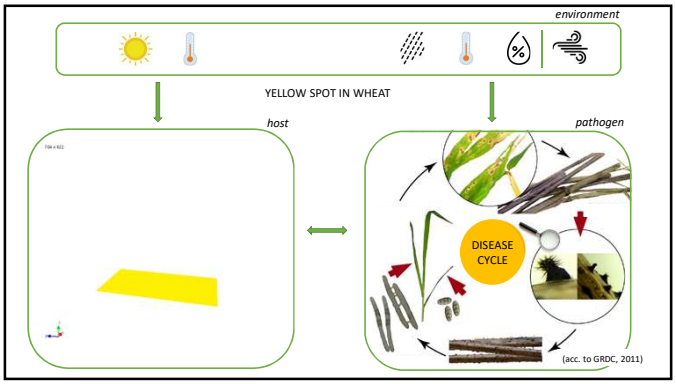
(Galloway *et al.*, 2009) (GRDC, 2009)

(Streit *et al.*, 2017)

Case study #1

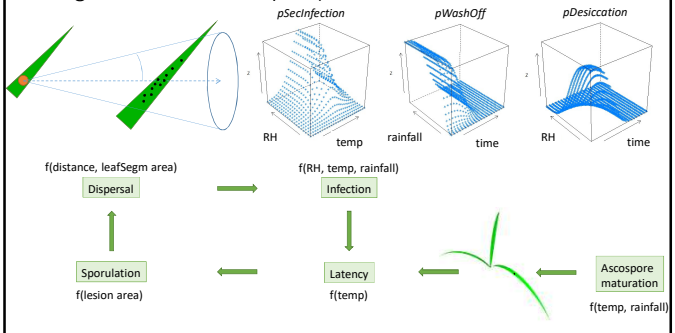
- **Yellow spot on wheat**
- Caused by a necrotrophic fungus *Pyrenophora tritici-repentis*
- Of great concern to growers and wheat industry
  - Annual losses of wheat crop value from diseases in AUS ~19.5% / $913M (Murray & Brennan, 2009)
  - Yellow spot dominating the loss ~23% / $212M

(GRDC, 2011)



(acc. to GRDC, 2011)

Substages of the disease cycle (in the model)



Coupled model – disease progression (schematic)

primary inoculum

Coupled model – disease progression (schematic)

spread by wind and secondary infection

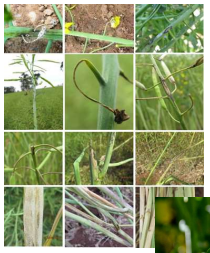
Coupled model – disease progression (schematic)

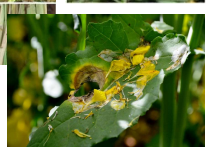
multiple secondary infection and spread upwards

New case studies

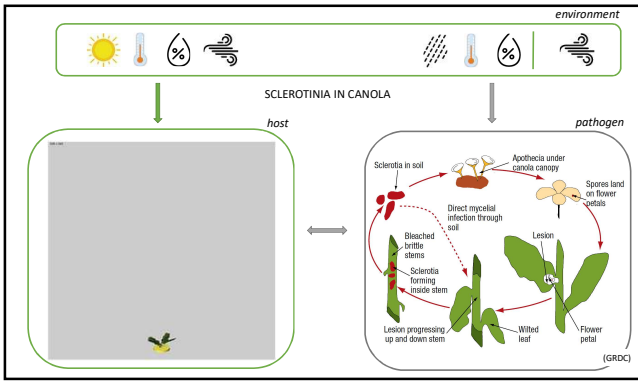
- **Upper canopy blackleg and Sclerotinia in canola**
- Serious damaging diseases in canola

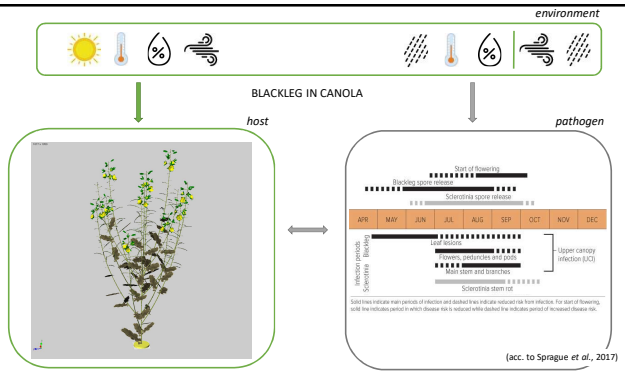
- **How can we apply the combined approach to study these new pathosystems?**





(Sprague *et al.*, 2017; DPIRD, 2018)





How can the modelling help?

- Virtual trials with the coupled models; different scenarios
- Impact on disease progression and yield
  - Seeding time
  - Flowering time
  - Branching pattern
  - Plant & row distances
  - Weather conditions for different seasons / locations
- Impact of microclimate (e.g. dense canopies retain more moisture)

(Cresswell)

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Thank you for your attention.