UNIVERSITY OF LIVERPOOL

Department of Evolution, Ecology and Behaviour

CROP RESISTANCE, BIOLOGICAL MODELS, AND AI-VISION

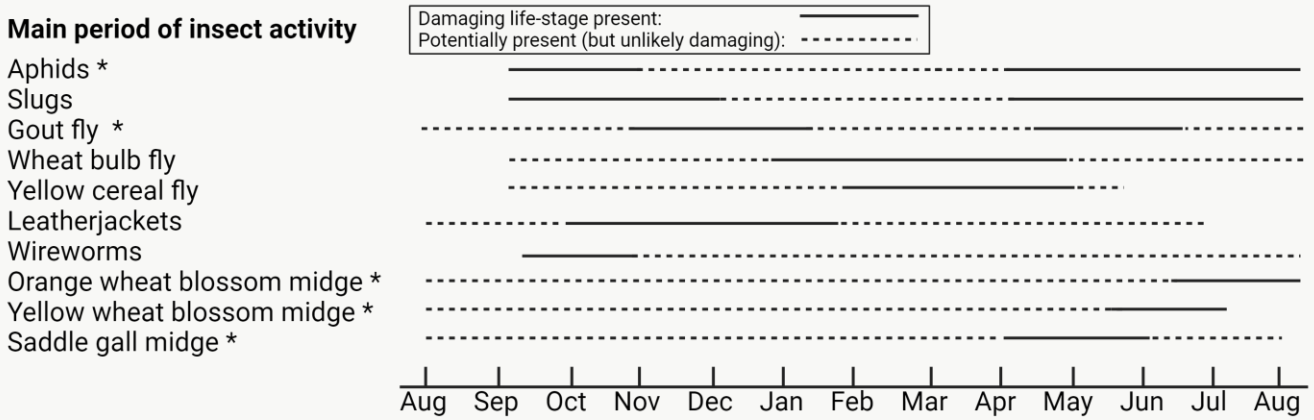
Methods to support pest and virus management

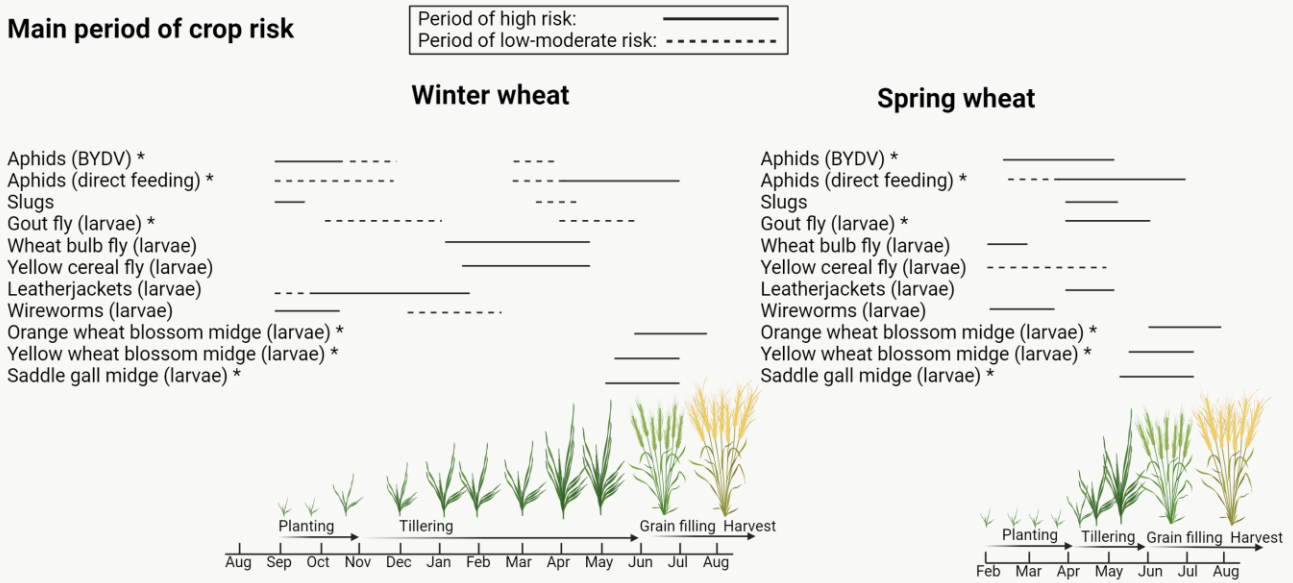
Dr Daniel Leybourne
1851 Research Fellow

November 2024



PESTS, VIRUS & AGRICULTURE







Leybourne et al., 2024. *Agronomy for Sustainable Development.*

METHODS TO SUPPORT PEST AND VIRUS MANAGEMENT

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- Part 1: Screening for BYDV tolerance
- Part 2: Biological models to understand vector-virus-host interactions
- Part 3: Computer vision to support pest management





METHODS TO SUPPORT PEST AND VIRUS MANAGEMENT

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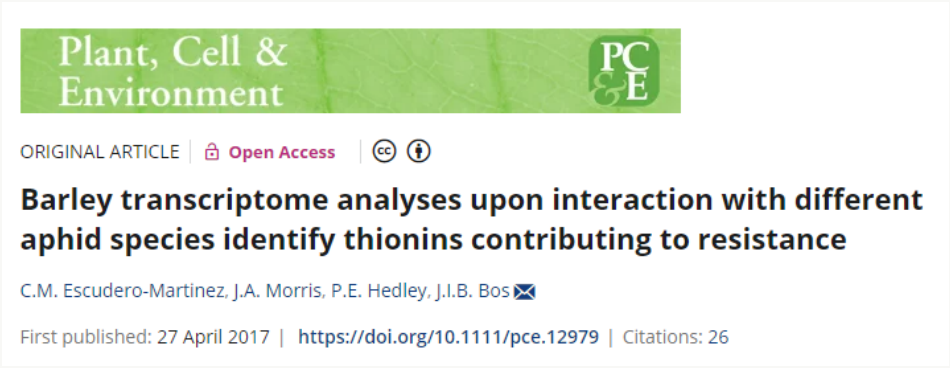
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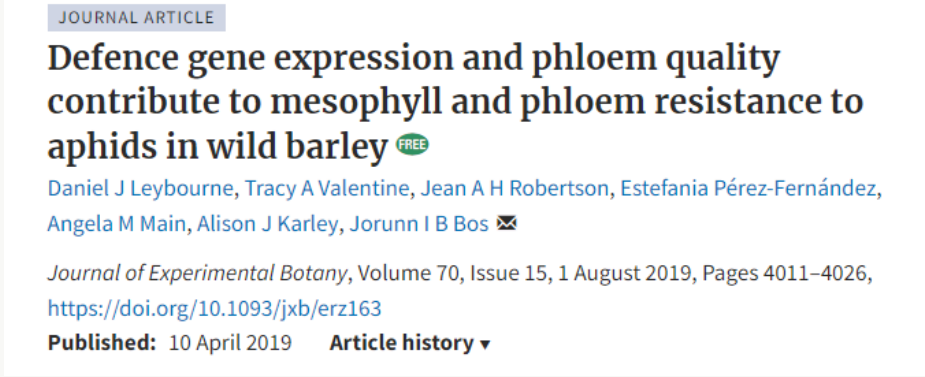




1: SCREENING FOR BYDV TOLERANCE

- Aphid resistance identified in some wild relatives
- Evidence for role of thionin in aphid resistance (barley)







- Pan-genome based on ~76 barley lines
- Multiple gene families
- Including **thionin** gene family

- Dr Jorunn Bos
- PhD Student (Yan Fu) screening ~ 20 lines for aphid resistance
- Liverpool: Screen for **virus tolerance**

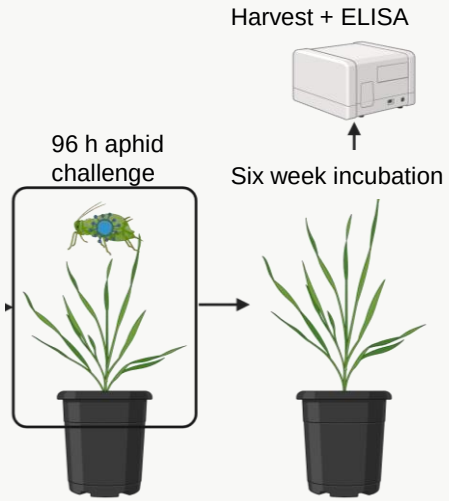
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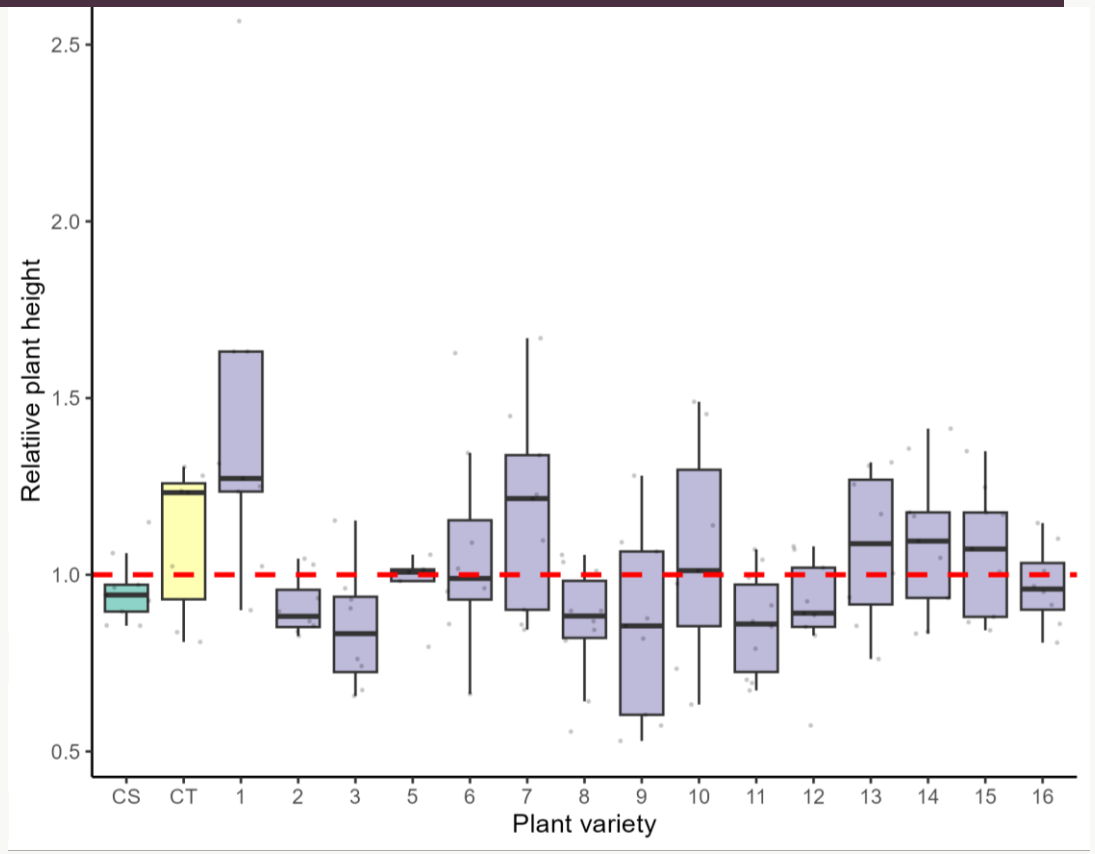
- 16 barley varieties
- 2 controls
  - KWS Orwell (susceptible)
  - KWS Ferris (tolerant)

- Challenge with viruliferous (BYDV-PAV) or “mock” aphids

- Measure plant physiology and BYDV titre







- Potential tolerance and compensatory growth

Next-steps:
- More replicates
- Tissue analysis to examine leaf biochemistry (FTIR)

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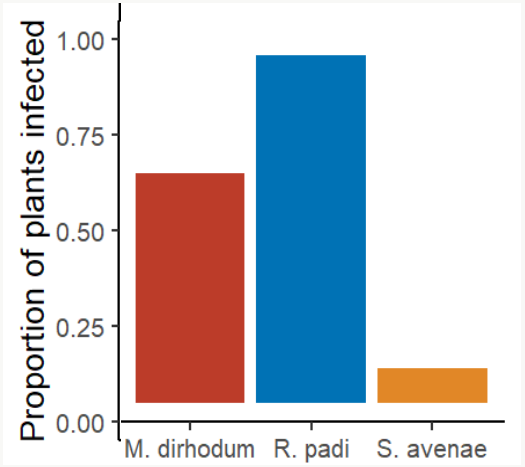
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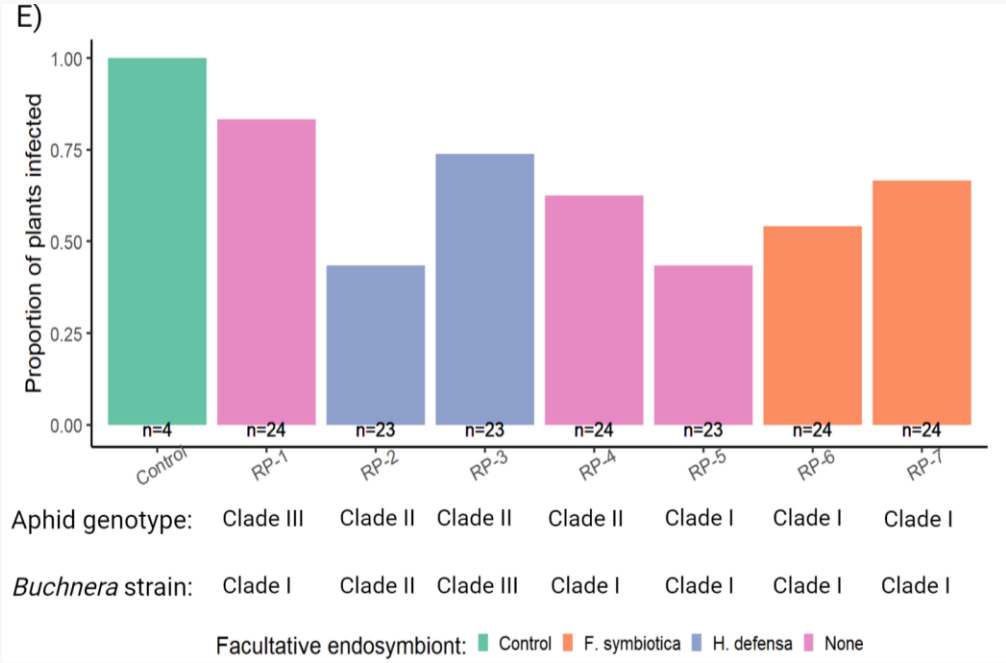


2: BIOLOGICAL MODELS – UNDERSTANDING VECTOR-VIRUS-HOST INTERACTIONS

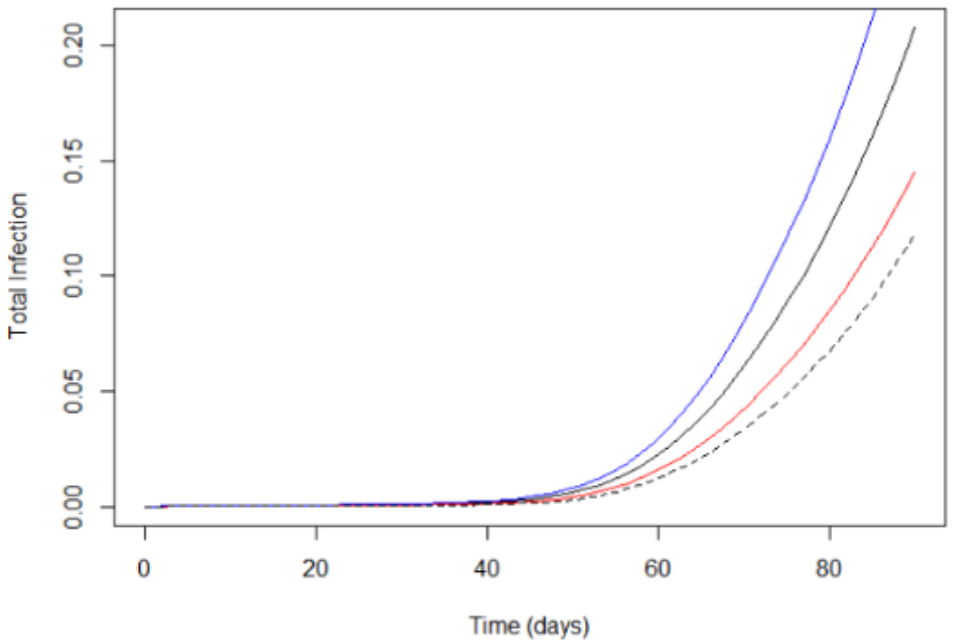
- Aphid species vector different virus species with variable efficacy
- Aphid phenotype (virus and life-history) differs between populations within a given species
- These will all ultimately interact to influence vector-virus-host dynamics
- Model these interactions?







2: BIOLOGICAL MODELS – UNDERSTANDING VECTOR-VIRUS-HOST INTERACTIONS

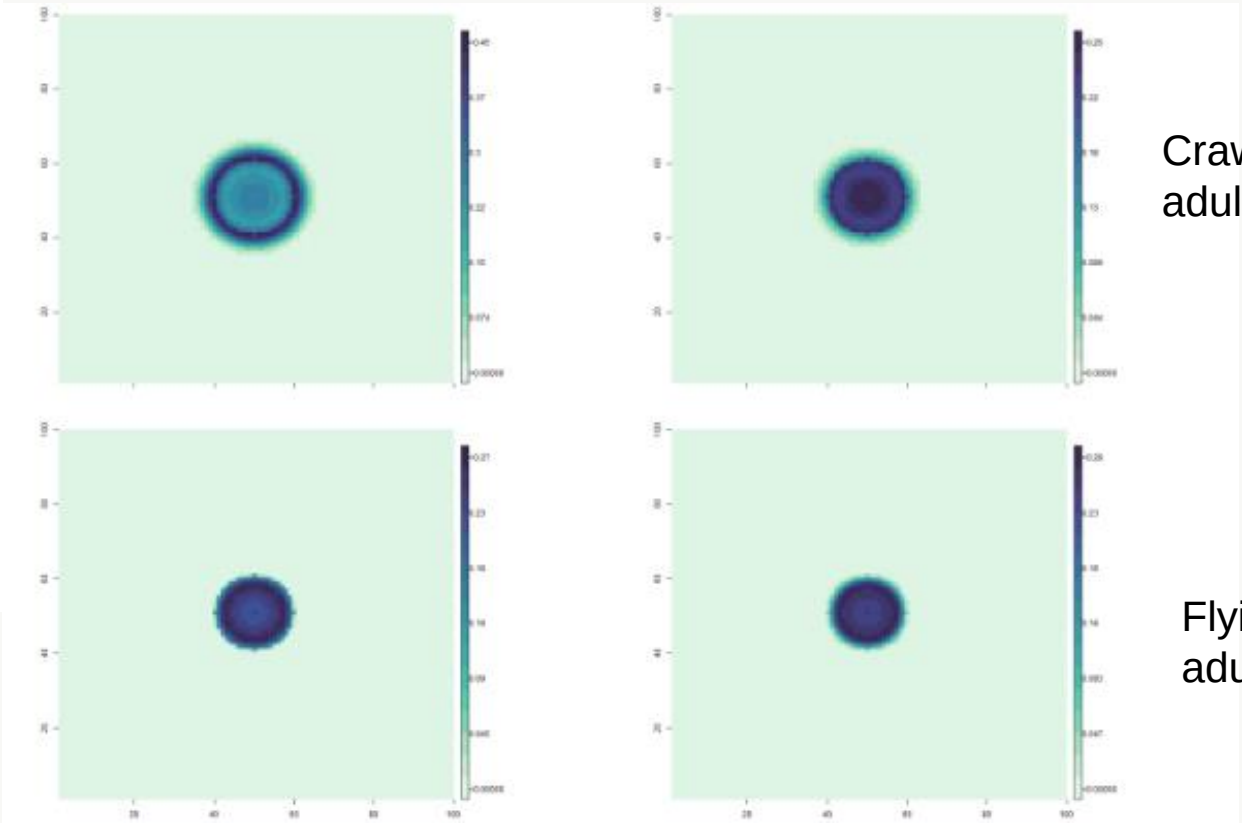




- BYDV-PAV transmission
- Three *R. padi* genotypes
- *S. avenae* comparison

Preedy, …, Leybourne. *In Prep*

S. avenae *R. padi*



Crawling adult

Flying adult

METHODS TO SUPPORT PEST AND VIRUS MANAGEMENT

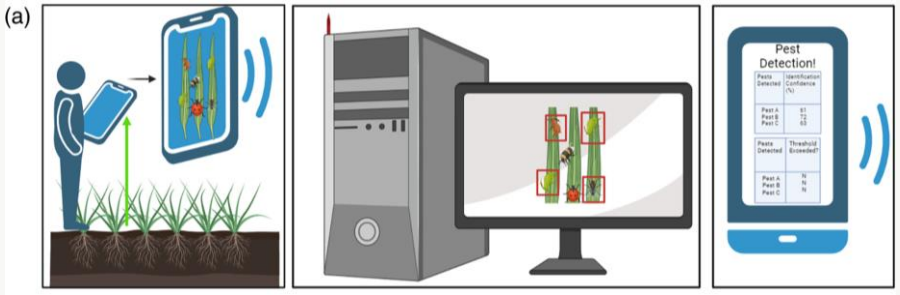
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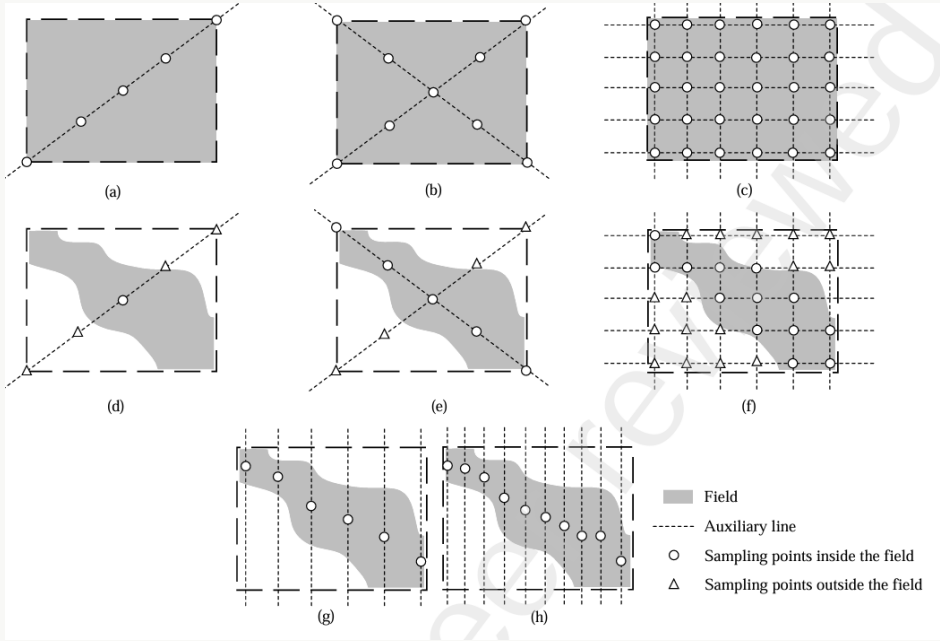


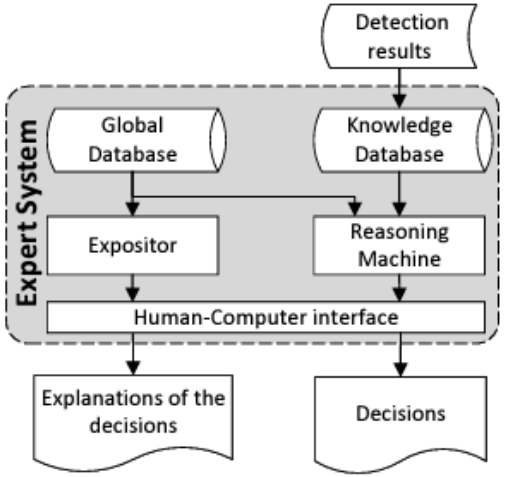


3: COMPUTER VISION TO SUPPORT PEST MANAGEMENT



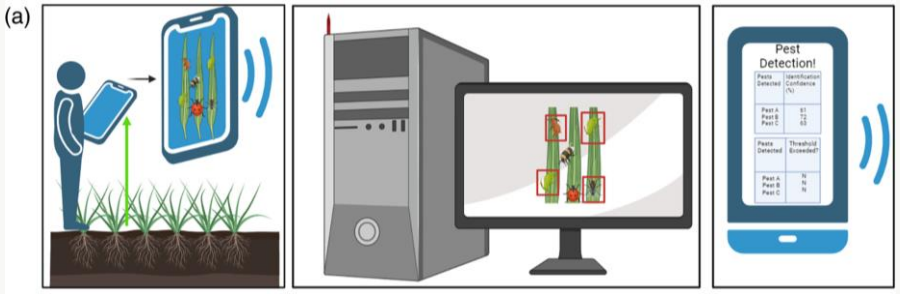






Li et al. (2024). *Journal of Industrial Information Integration*

3: COMPUTER VISION TO SUPPORT PEST MANAGEMENT





Li et al. (2024). *Journal of Industrial Information Integration*

SUMMARY

- Part 1: Screening for BYDV tolerance
- Part 2: Biological models to understand vector-virus-host interactions
- Part 3: Computer vision to support pest management





ACKNOWLEDGEMENTS

- Elinor Baird

- Dr Jorunn Bos (JHI)
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- Dr Po Yang (Sheffield University)

