

# Somaclonal selection for enhanced resistance to *Spongospora* root infection and studies on zoospore release

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# Outline

- Background
- Objective and Methodologies
- Preliminary Results
- Research Directions
- Acknowledgment





- ...susceptibility to root infection should be assessed as well – **Merz and Falloon 2009**
- ...high root susceptibility are likely to be a particular risk factor in potato production – **Merz and Falloon 2009**
- Potato breeders should focus more attention on powdery scab resistance – **Merz 2008**





# Breeding for Resistance

- Conventional – Hybridization and selection
- Genetic Engineering (Recombinant DNA Technology)
- Biotechnological Methods (***In vitro* Selection and Somaclonal Variation**)





## The regeneration and screening of watercress somaclones for resistance to *Spongospora subterranea* f. sp. *nasturtii* and measurement of somaclonal variation

J. R. Claxton<sup>1</sup>, D. L. Arnold<sup>2</sup>, J. M. Clarkson & D. Blakesley

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### Genetics and Resistance

## Stable and Extreme Resistance to Common Scab of Potato Obtained Through Somatic Cell Selection

Calum R. Wilson, Robert S. Tegg, Annabel J. Wilson, Gregory A. Luckman, Alieta Eyles, Zi Qing Yuan, Leon H. Hingston, and Anthony J. Conner

First, second, third, fourth, sixth, and seventh authors: Tasmanian Institute of Agricultural Research (TIAR), University of Tasmania, New

University of  
h, Private Bag



Plant Pathology (2012)

Doi: 10.1111/j.1365-3059.2012.02698.x

## Somaclonal selection in potato for resistance to common scab provides concurrent resistance to powdery scab

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# Why Root Resistance?

- Roots – first in contact with the zoospores
- Phytochemicals released in the root encourage zoospore release and chemotaxis
- Root galls – sources of inoculum
- Growing evidence on the negative effect of root infection to the plant







# Objective 1

- To develop and select potato somaclones with enhanced resistance to root infection through cell selection technique.
  - Retain the desired tuber characteristics
  - Improved root system

cv. Russet Burbank

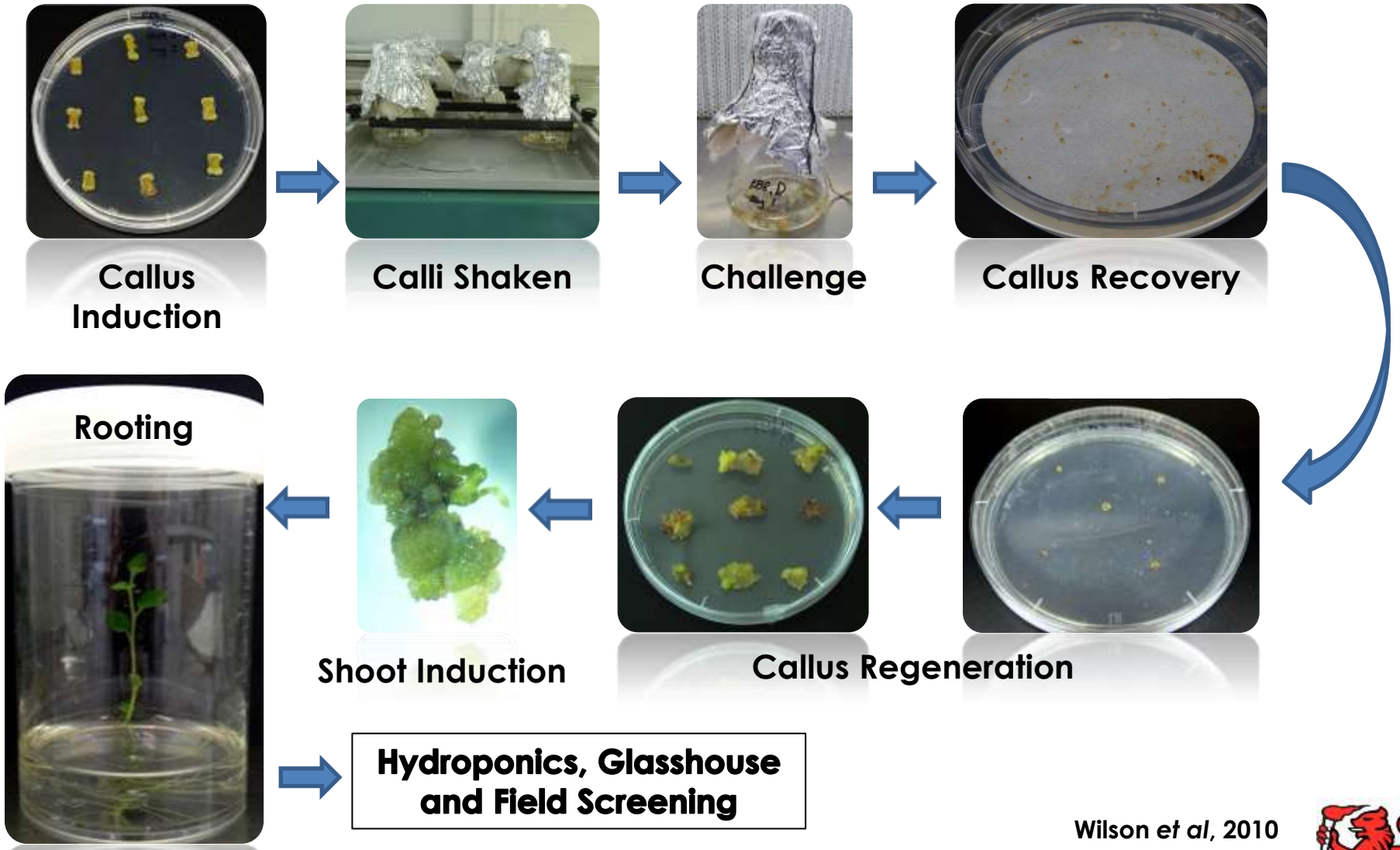
## Selective Agents

- Thaxtomin
- Root Extract – *S. subterannea* infected roots





# Method: Cell Selection



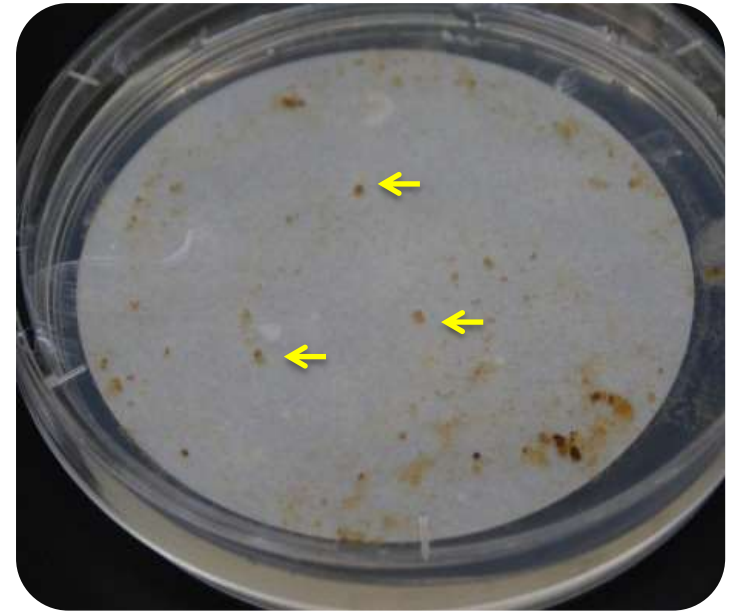
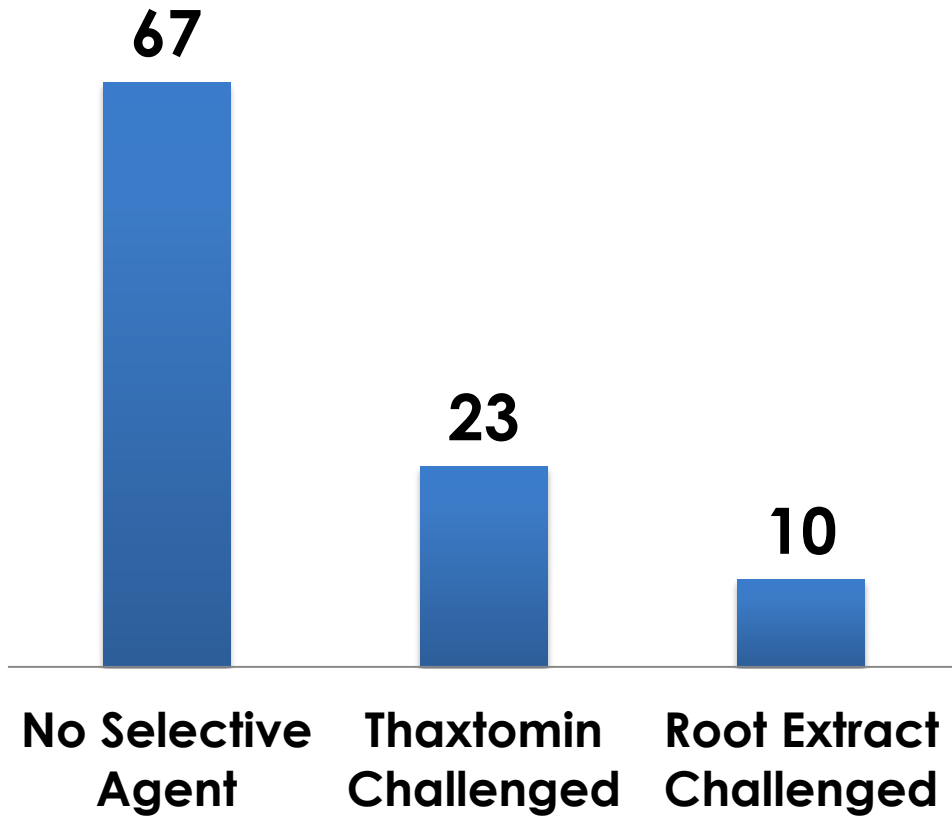
Wilson et al, 2010







# Number of Calli Recovered



**cv. Russet Burbank**





# Where to From Here?

- Assess rate of shoot induction from different selective agents
- Evaluate response of somaclones to *S. subterranea*
- Assess root traits/system of potato somaclones

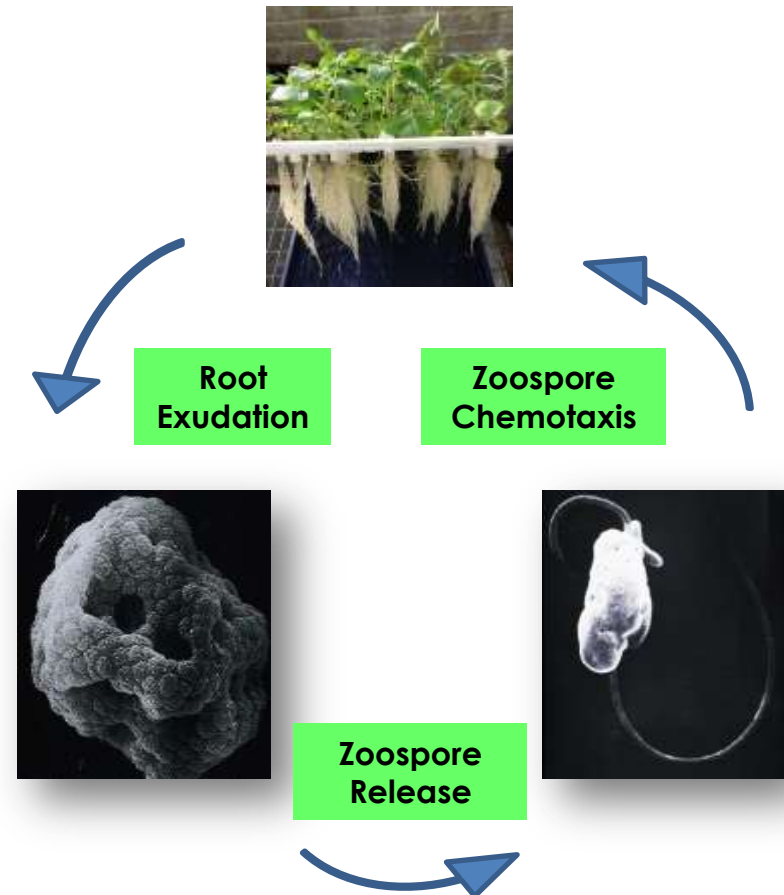




# Role of Root Exudates

## Disease Development

- Stimulate Germination (zoospore release)
- Positive chemotaxis



Sporosori and zoospore. Merz, U. 2013. Spongospora Competent Center.





## Objective 2

- To evaluate the response of *S. subterranea* to potato root exudates.
  - a. Zoospore Release
  - b. Zoospore Chemotaxis
  
- To identify molecules/compounds in root exudates.





## ■ Zoospore Release

- No. of Zoospores – Microscopy
- Root-infection – Plant bio-assay
- Pathogen concentration – qPCR analysis

## Zoospore Chemotaxis

- Attraction/Repulsion – Microscopy

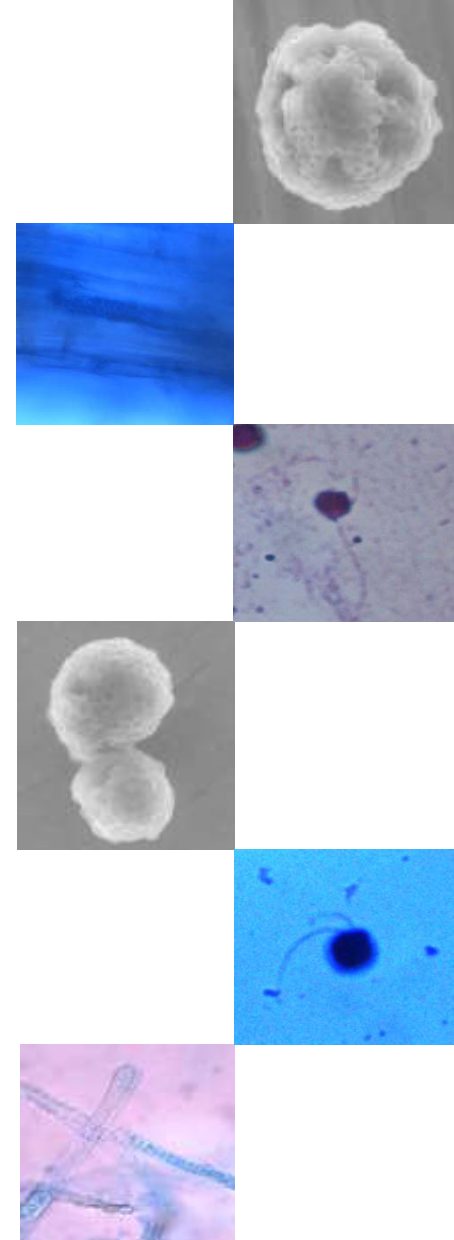
## ■ Root exudates chemical composition

- Analytical chemistry techniques e.g. liquid chromatography, mass spectrometry





# Preliminary Results

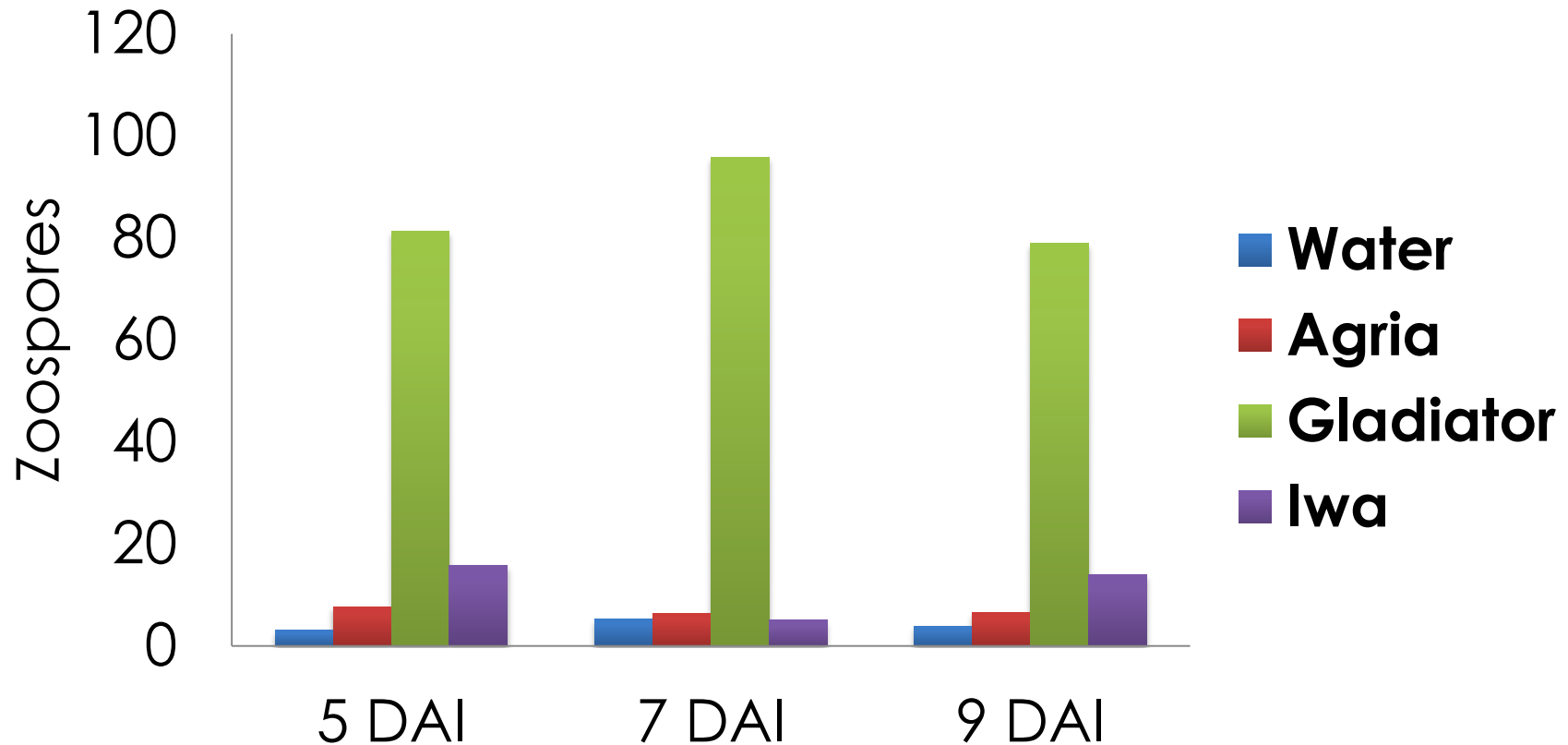






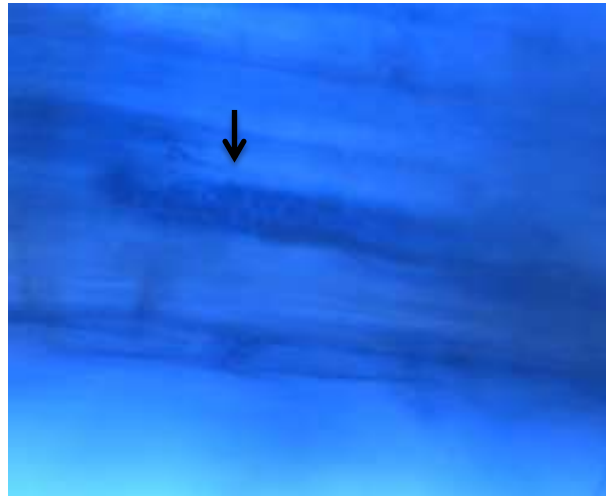
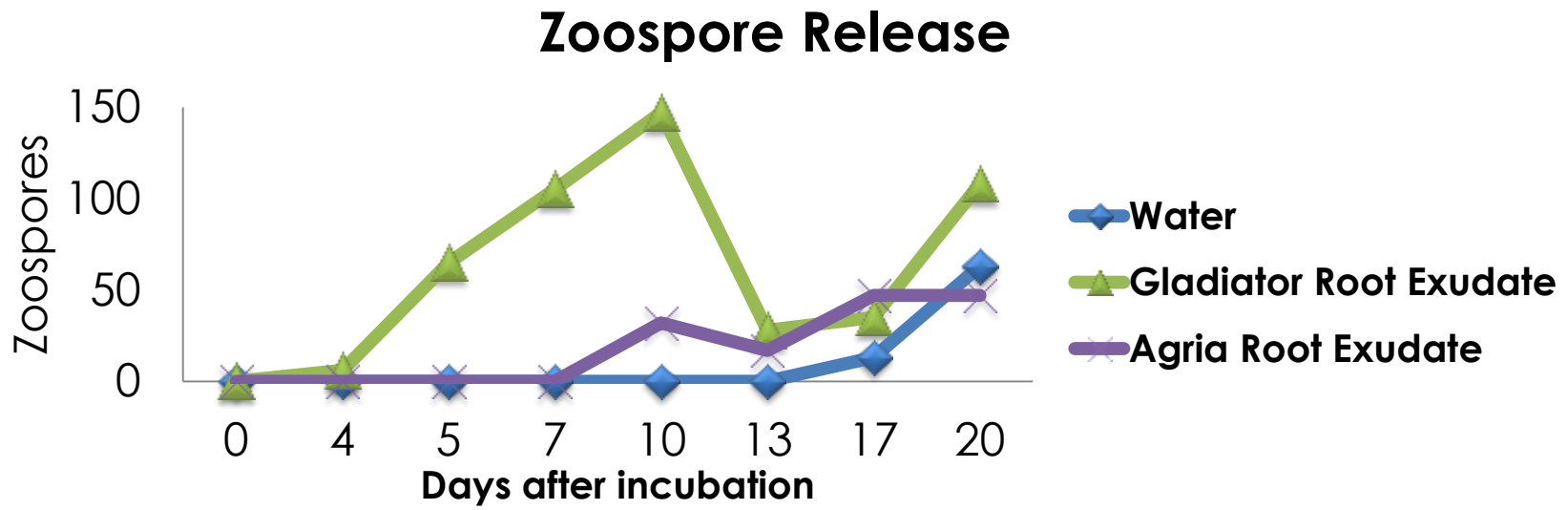
# Zoospore Release – Root Exudates

## Zoospore Release





# Zoospore Release...Continued



**Root Infection**



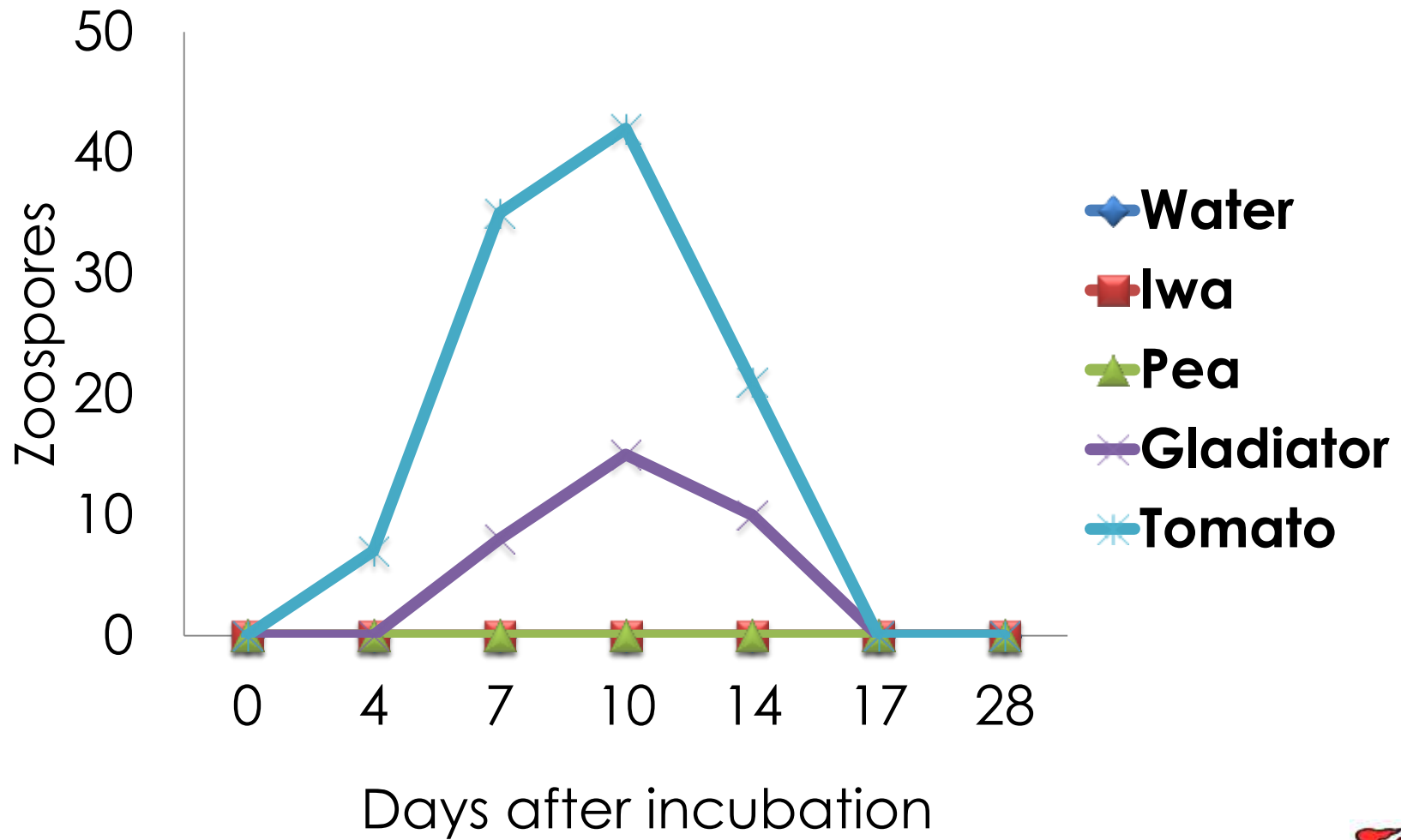
**Root Hair Infection**





# Zoospore Release...Continued

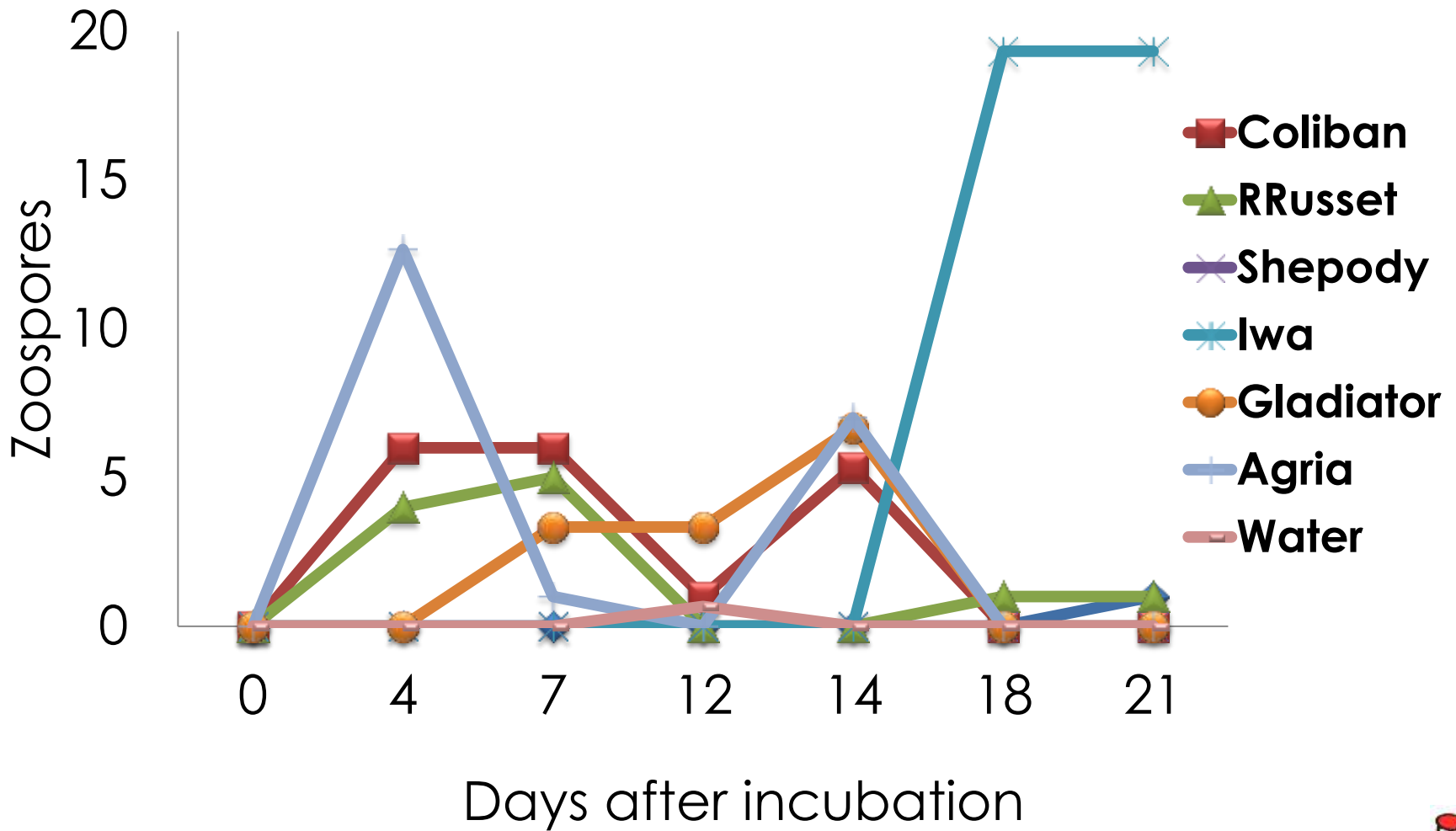
## Zoospore Release



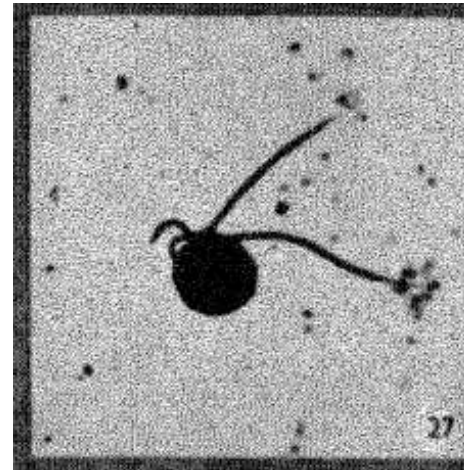
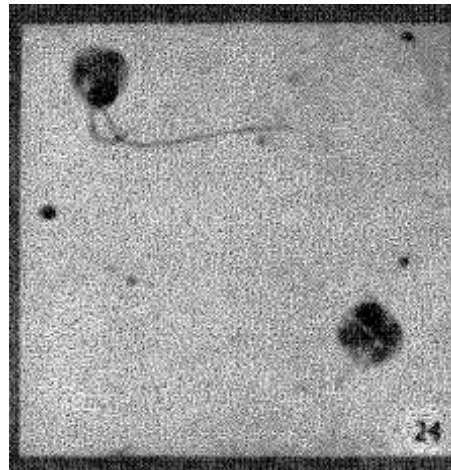
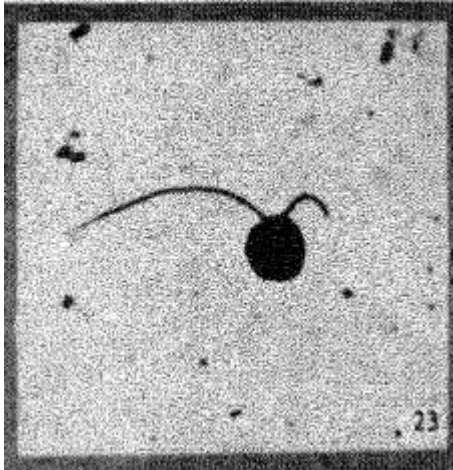


# Zoospore Release...Continued

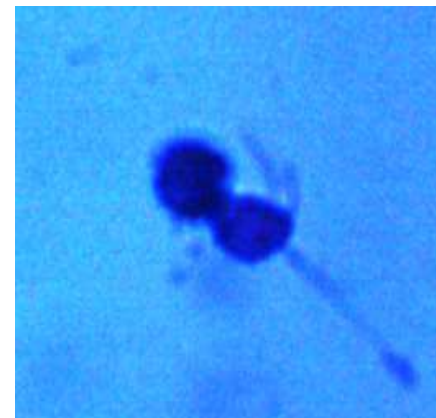
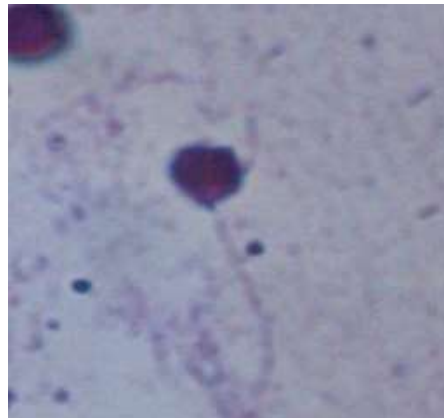
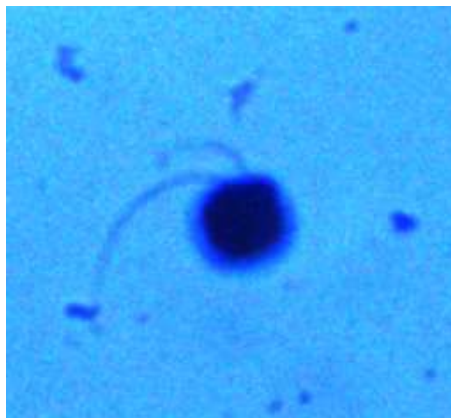
## Zoospore Release



*Kole, 1953*



*Balendres, Tegg, and Wilson, 2014 \**





# Where to From Here?

- Evaluate the effect of root exudates on zoospore chemotaxis
- Identify chemicals in root exudates







# Objective 3

- Quantify yield loss in glasshouse and field under Tasmanian conditions





“When all stakeholders involved in the potato business become aware that **solution of powdery scab problems is likely to be a long term goal**, when a range of **resistant cultivars are available** and when powdery scab risk can be accurately predicted for seed tuber lines and for fields, then the mission to find effective control of this important disease will become accomplishable

**Merz and Falloon (2009)**





# Thank You!

## The Team

Dr. Calum Wilson  
Dr. Robert Tegg  
Dr. David Nichols  
Ms. Annabel Wilson  
Mr. Tamil Thangavel

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Dr. Ueli Merz – *ETH Zurich, Switzerland*  
Dr. Tony Conner – *agresearch New Zealand*  
Dr. Alieta Eyles – *TIA, UTAS*



Tasmanian Graduate  
Research Scholarship

