Resistance testing for *Pectobacterium* and *Dickeya*

Ian Toth

The James Hutton Institute

Control of blackleg disease

- Blackleg and soft rot diseases are caused by *Pectobacterium* and *Dickeya* spp. and are currently controlled by:
  - Crop inspection at different stages of seed production (those that are infected are heavily removed from the seed production chain)
  - Good storage temperature and ventillation that prevent disease development in store (but have little effect on disease development once back in the field)
  - Deployment of cultivars with disease resistance
  - Czajkowski *et al.* 2011 Plant Pathol. 60, 999

Disease resistance

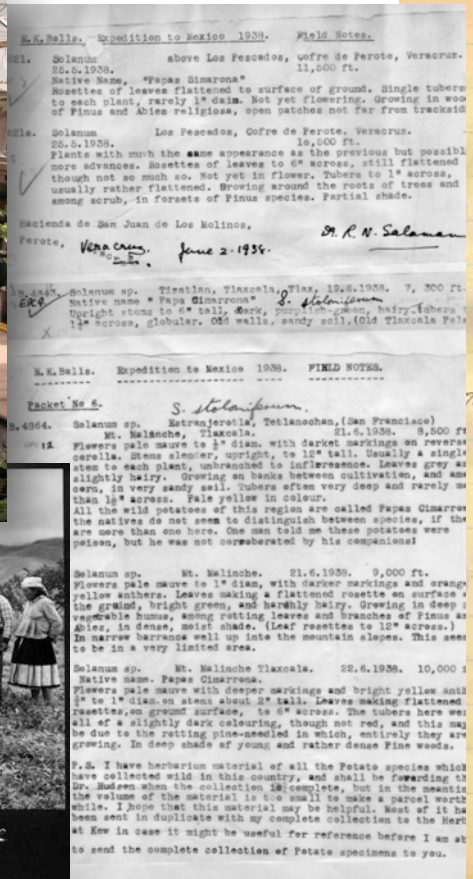
- Few potato cultivars show resistance / tolerance to blackleg and soft rot.
- Some cultivars show partial resistance.
- Attempts to breed cultivars of *Solanum tuberosum* with increased resistance have been only partially successful, perhaps due to a narrow range of genetic diversity being used in parental material.

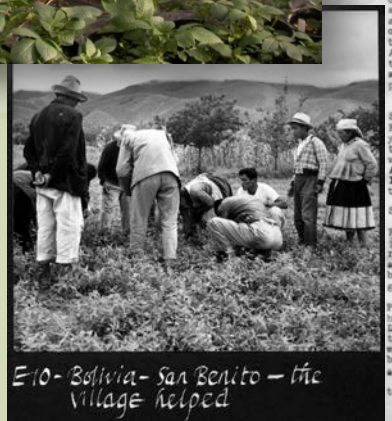
Finlay Dale

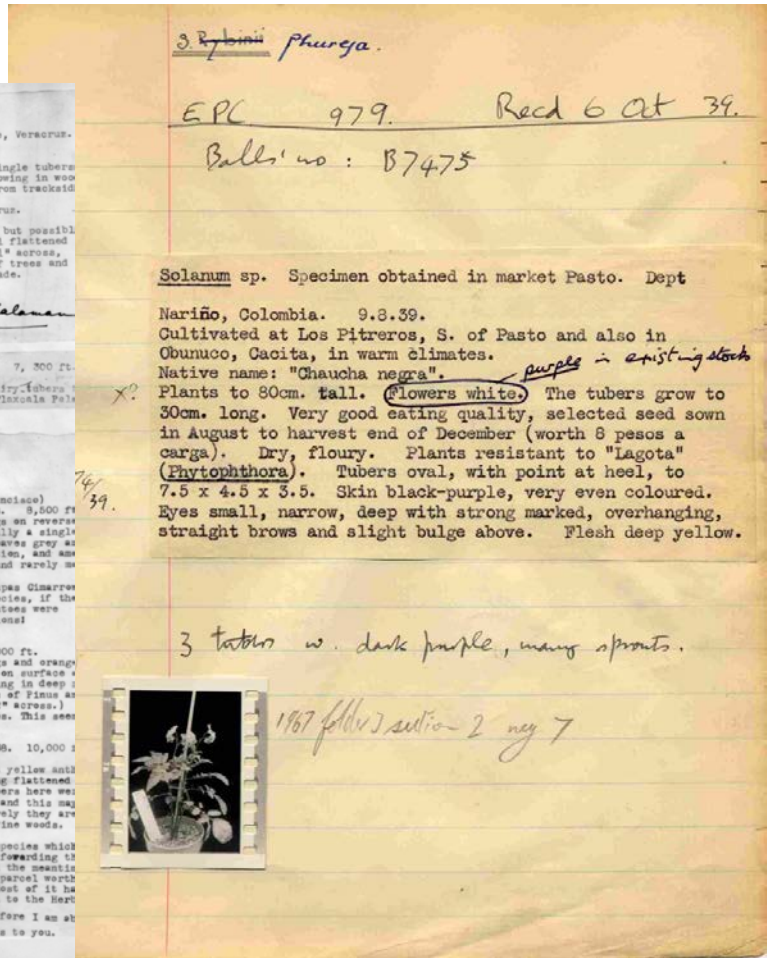
Discovering resistance in the Commonwealth Potato Collection (CPC)

The James Hutton Institute

- 1500 accessions of ca. 80 wild and cultivated potato species.







Solanum phureja

The James Hutton Institute

Disease resistant varieties

- Crosses between *S. tuberosum* (tetraploid) and *S. phureja* (diploid) display relatively high resistance but tuber yields are reduced.
- There is a lack of resistant tetraploid parental germplasm available to breeders world-wide.
- Of the 245 culivars in the 'British Potato Variety Database' only 17 show moderate to high resistance, 5 of which include *S. phureja* material.

Resistance to Damage, Pests and Diseases	Low	.	.	.	.	.	.	.	High
Dry rot (*Fusarium coeruleum*)	.	.	.	.	5				
Dry rot (*Fusarium sulphureum*)	1								
Late blight on foliage (*Phytophthora infestans*)	.	.	.	4					
Late blight on tubers (*Phytophthora infestans*)	.	.	.	.	.	.	7		
Powdery scab (*Spongospora subterranea*)	.	.	.	.	.	.	7		
Blackleg (*Pectobacterium atrosepticum*)	.	.	.	.	.	.	.	8	
Common scab (*Streptomyces scabiei*)	.	.	3						
Potato Cyst Nematode (*Globodera pallida Pa 2/3, 1*)	.	2							
Potato Cyst Nematode (*Globodera rostochiensis Ro1*)	1								
Potato Leafroll Virus	.	.	.	.	5				
Potato Virus Yo	.	2							
Bruising	.	.	.	.	.	.	.	.	9
Splitting	.	.	.	.	.	6			

The project

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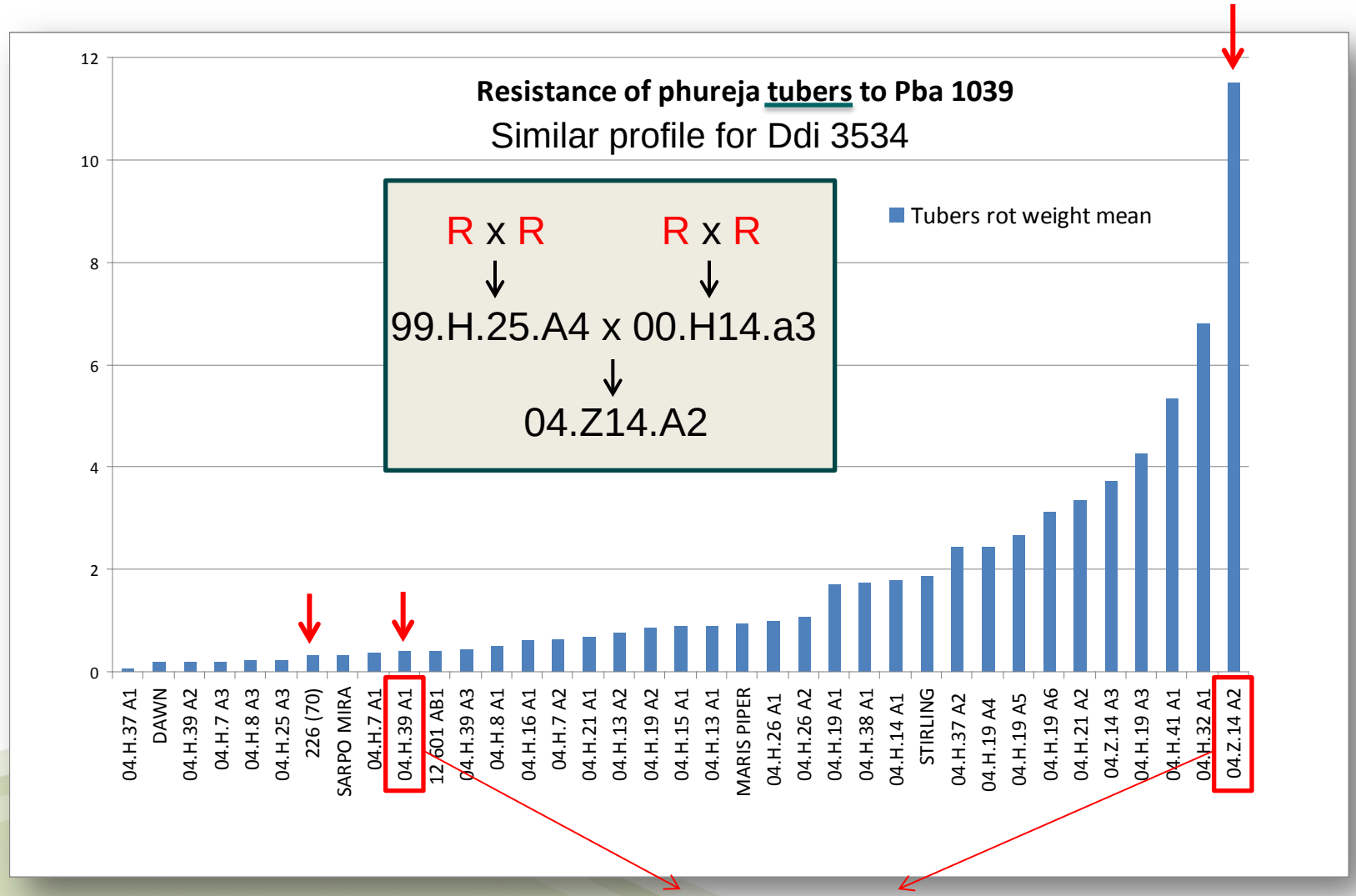
This project is to investigate and identify the source(s) of resistance in *S. phureja* to allow it to be fully exploited in developing new resistant (tetraploid) cultivars

Resistance to multiple strains and species



07.H.128

Tested in 2013

Populations to test

Testing 2013

04.Z14.A2 x 04.H.39.A1 → 07.H.128

04.Z14.A2 x 226(70) → 10.H.1

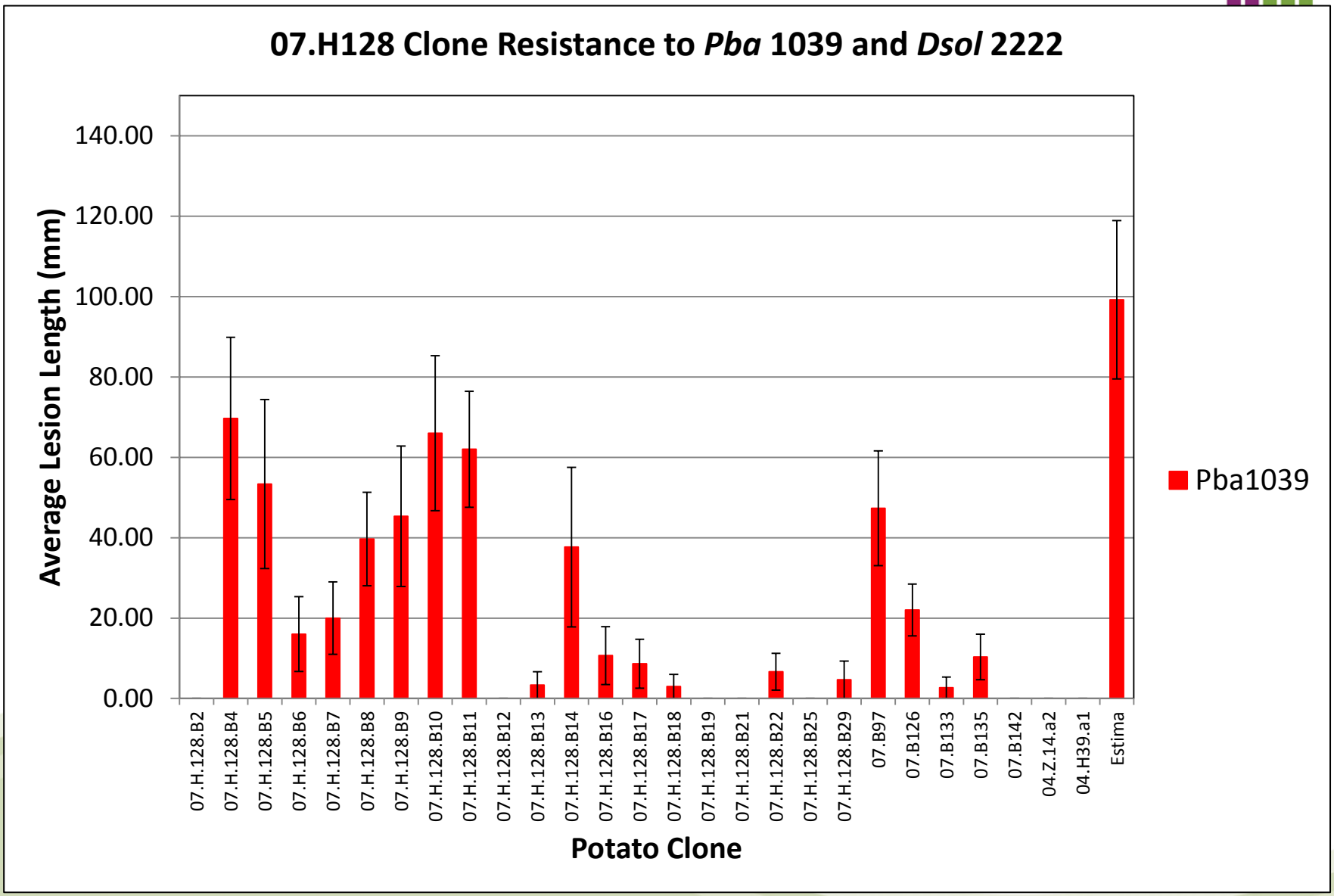
Testing 2014

Crossed 2013

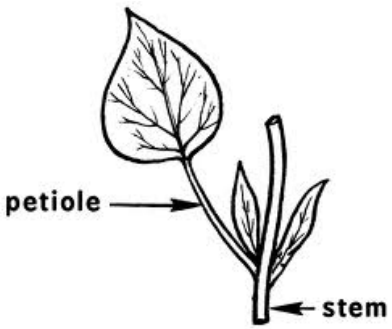
04.H.37.A2 x DB226(70)
04.H.14.A1 x DB226(70)
04.H.37.A2 x 04.H.39.A1
04.H.14.A1 x 04.H.39.A1

99.H.25.A4 x 00.H14.A3 → New popul. equivalent to 04.Z14

200 true seed planted 2013

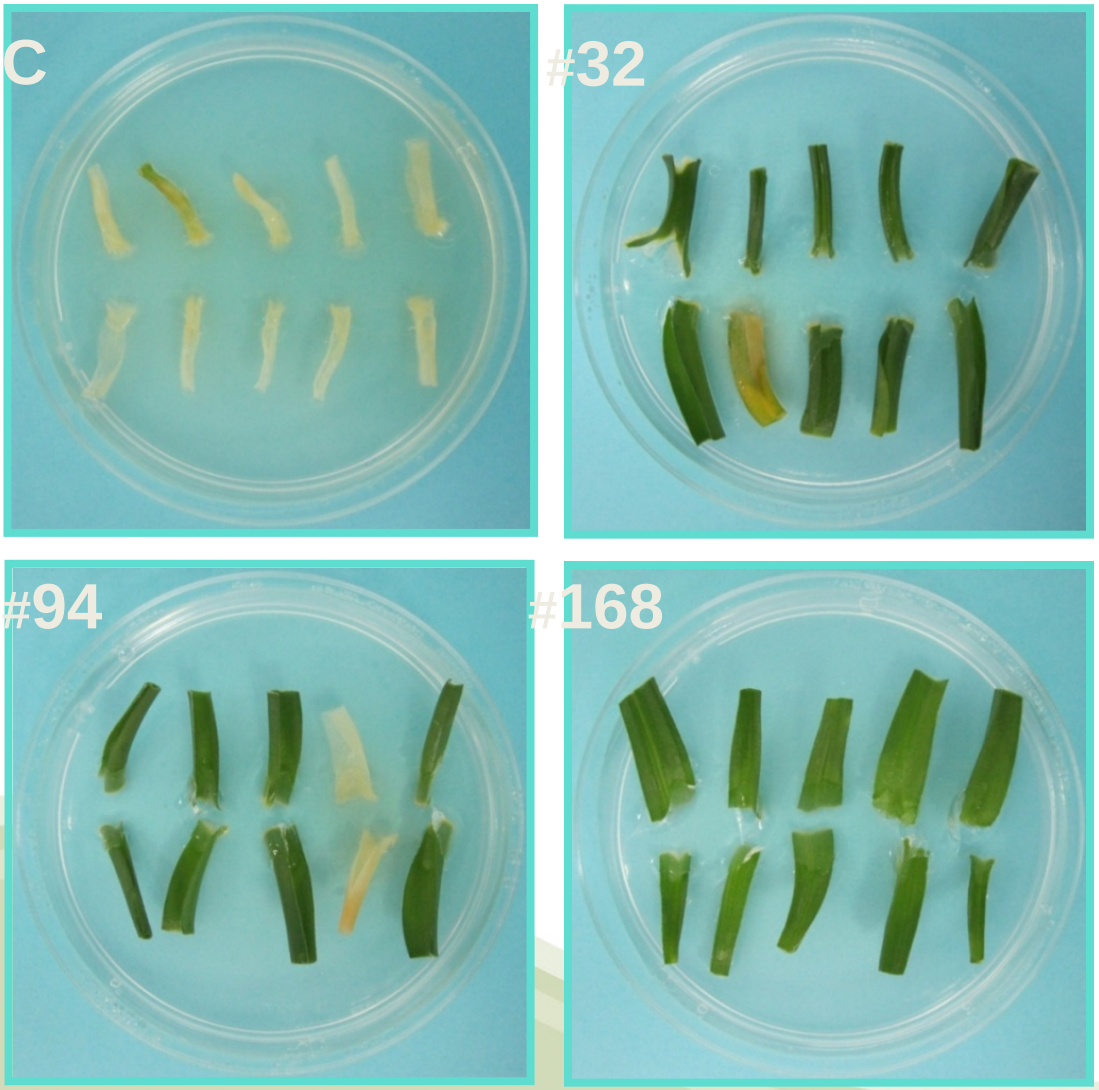

07.H128 Clone Resistance to *Pba* 1039 and *Dsol* 2222
Average Lesion Length (mm)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
07.H.128.B2
07.H.128.B4
07.H.128.B5
07.H.128.B6
07.H.128.B7
07.H.128.B8
07.H.128.B9
07.H.128.B10
07.H.128.B11
07.H.128.B12
07.H.128.B13
07.H.128.B14
07.H.128.B16
07.H.128.B17
07.H.128.B18
07.H.128.B19
07.H.128.B21
07.H.128.B22
07.H.128.B25
07.H.128.B29
07.B97
07.B126
07.B133
07.B135
07.B142
04.Z.14.a2
04.H39.a1
Estima
Potato Clone
Pba1039

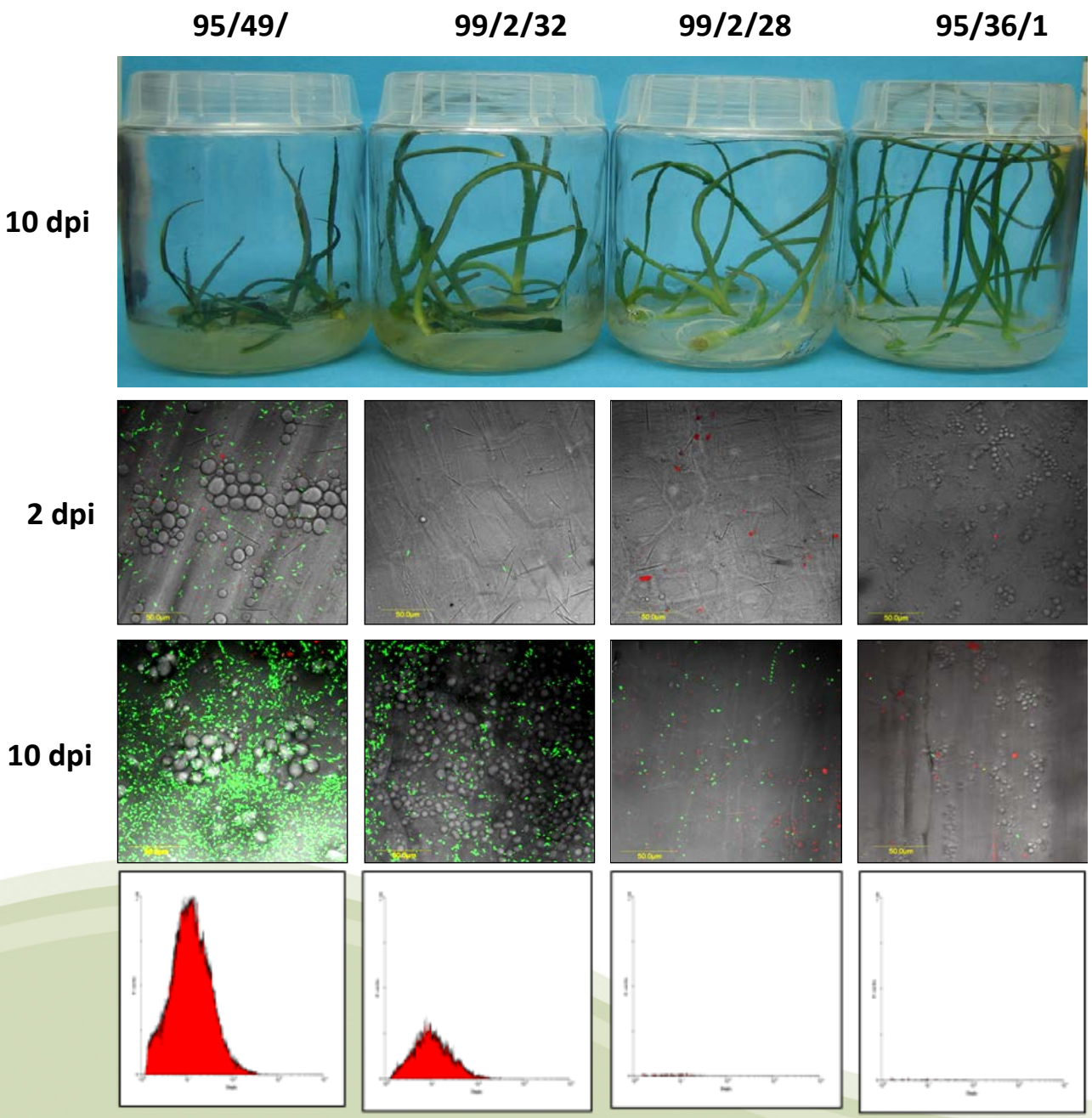
Development of a new test



- Root cuttings
- Vacuum infiltration of whole seedling
- Increased humidity
- Forceps damage to leaf
- Petiole test (vd Wolf)

Leaf segment assay





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Future work

- Develop a high throughput glasshouse method.
- Test bacterial growth and strain movement (using GFP) to ensure that both parental material and resulting progeny are resistant rather than tolerant.
- Test resistant material against other strains and species.

Acknowledgements

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The James Hutton Institute

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Riaghaltas na h-Alba