THE TEAM

• Louise-Marie Dandurand (University of Idaho)
• Benjamin Mimee (Agriculture AgriFood Canada)
• Vivian Blok and John Jones (James Hutton Institute)
• Dee Denver (Oregon State University)
• Eric Greiner (INRA France)
• Xiaohong Wang and Inga Zasada (USDA-ARS)
RISK ASSESSMENT

- Potential for invasion and spread
- Spatial analysis and interpolation of invasion for Idaho
- Predicted yield impact
- Genetic diversity of Idaho population
- Global characterization of *Globodera*
- Diagnostic marker development

RISK MANAGEMENT

- New and improved genomes
- Increased knowledge of virulence factors
- Novel sources of resistance
- Phenotyping for *Globodera* resistance
INVASION AND SPREAD OF *G. PALLIDA* IN IDAHO

Region

- The infestation in Idaho is highly aggregated and spatially-clustered
- Contagion effect scenario (cysts from one field infested others)
- Spread by equipment contaminated by infested soil

Field
GLOBODEREA PALLIDA INTRODUCTION IN IDAHO WAS A SINGULAR EVENT

- Low genetic diversity among Idaho *G. pallida* populations; uniform distribution
- Genetic diversity in populations from Scotland is higher than from Idaho

Spatial Analysis

Genetic Analysis

Max Fst = 0.12

Max Fst = 0.30
DIVERSITY AND CHARACTERIZATION OF GLOBODERA GLOBALLY

- Phylogenetic links between populations
- Confirmed the routes of introduction
- Markers for new introductions from South America
- Markers for pathotypes
**NEW AND IMPROVED GENOMES OF GLOBODERA SPP.**

- ~ 1,250 gene models manually annotated by Jamboree participants

<table>
<thead>
<tr>
<th></th>
<th>Published G. pallida</th>
<th>New G. pallida</th>
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<tbody>
<tr>
<td>Size (Mb)</td>
<td>124.6</td>
<td>119.6</td>
</tr>
<tr>
<td>Scaffolds (n)</td>
<td>6,873</td>
<td>163</td>
</tr>
<tr>
<td>Scaffold N50 (bp)</td>
<td>121,687</td>
<td>2,251,599</td>
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<td>Longest scaffold (bp)</td>
<td>600,076</td>
<td>8,303,766</td>
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<tr>
<td>GC (%)</td>
<td>37</td>
<td>37</td>
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<tr>
<td>Ns (bp)</td>
<td>21,024,229</td>
<td>1,245,593</td>
</tr>
<tr>
<td>BUSCO (%)</td>
<td>74 (CEGMA)</td>
<td>94</td>
</tr>
<tr>
<td>Predicted genes (n)</td>
<td>16,000</td>
<td>19,088</td>
</tr>
</tbody>
</table>

- Retrained annotation contains 16,292 coding regions (Gp = 16,403; Gr=14,308)

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**Globodera pallida**

**Globodera ellingtoniae**
DIAGNOSTIC MARKER DEVELOPMENT FOR G. ROSTOCHIENSIS PATHOTYPES
**DECISION SUPPORT SYSTEM FOR AGROTECHNOLOGY TRANSFER - DSSAT**

- *Globodera pallida* decreased potato yield:
  - $P_i = 10$ eggs/g soil – 15%
  - $P_i = 20$ eggs/g soil – 28%
  - $P_i = 40$ eggs/g soil – 44%
  - $P_i = 80$ eggs/g soil – 87%

- DSSAT potato growth model applied to PCN impact predicts **significant potato yield reduction** in heavily infested fields.
EVALUATED > 1,000 GENOTYPES FOR GLOBODERA SPP. RESISTANCE

- Western x Eden population
- Potato varieties
- Wild Solanum spp.
- Novel sources of resistance

- G. pallida
- G. rostochiensis
- G. ellingtoniae

Tuber production (CETS phytotron) → Canister assay for large-scale and rapid screening for PCN resistance
NOVEL SOURCE OF RESISTANCE IN SOLANUM SPEGAZZINII

Resistant to G. pallida and G. rostochiensis
INCREASED KNOWLEDGE OF G. PALLIDA VIRULENCE FACTORS

G. pallida exposed to varieties with partial resistance may break ‘Innovator’ resistance

Genome regions showing variation identified and virulence candidates identified
TRANSCRIPTOMIC INSIGHTS INTO GLOBODERA BIOLOGY

Gene expression between Gr pathotypes

Analysis of survival and hatching transcriptomes

Genes involved in host specificity
OTHER OUTCOMES

• 4 post-doctoral scholars included in research efforts
• 5 graduate students trained
• ~ 20 publications
• 4 GLOBAL Nematology symposia at national/international meetings
• > 40 presentation given to stakeholders and scientific communities
FUTURE??

• How do we keep this productive collaboration alive?
• Continued need to share resources and methodologies to more rapidly advance science
• Continued cross laboratory training of students