Molecular identification of weeds: *Tradescantia*

Dagmar Goeke

Ecological Genetics group

Landcare Research

Biosecurity Bonanza

Wellington, 6th June 2012
Biological control to beat weeds

Getting to know the weed
Conduct foreign exploration
Conduct host-specificity testing
Importation and quarantine
Field release
Monitoring and evaluation

Molecular tools for “species” identification
Biological control to beat weeds

Getting to know the weed

Conduct foreign exploration

Conduct host-specificity testing

Importation and quarantine

Field release

Monitoring and evaluation

How many invasive species are in New Zealand (NZ)?

T. big leaves, fluminensis, albiflora

* 5 mm
Biological control to beat weeds

Getting to know the weed

Conduct foreign exploration

Conduct host-specificity testing

Importation and quarantine

Field release

Monitoring and evaluation

What is the native range of our invasive *Tradescantia*?

somewhere in Brasil
Approaching genetic diversity

• **Sequence data analysis**

• DNA content measurements

• Microsatellite markers
Tradescantia DNA sequence data

*trnL-trnF* (chloroplast region)

Phylogenetic hypothesis for 68 within the Commelinaceae family, including 17 out of about 70 Tradescantia species*

*Burns et al., 2009,
DNA extraction

“happy” = healthy plant material
Sequence data analysis

- **Amplification** of diagnostic DNA region with universal primer combinations
- **Sequencing** and comparison to Genebank data
Tradescantia DNA sequence data

*trnL-trnF* (chloroplast region)*

- 20 samples of invasive *Tradescantia* (New Zealand)
- 18 samples of “related” *Tradescantia* (Brasil)

*Burns et al., 2009,
Tradescantia DNA sequence data

\textit{trnL-trnF} (chloroplast region)

\textbf{identical sequences} for

invasive \textit{Tradescantia} in NZ and 9 samples from Brasil

- NZ material: \textit{trnL-trnF} DNA region not diagnostic
- easy identification tool for foreign exploration
Approaching genetic diversity

- Sequence data analysis
- DNA content measurements
- Microsatellite markers
Polyploidy in plants

15% of angiosperm speciation events are accompanied by ploidy increase

Tradescantia: diploid – 22ploid (sets of chromosomes), 5-7 unique chromosomes, 12 - 132 in total

Humans: diploid, 23 unique chromosomes, 46 in total


Principle of flow cytometry

New Zealand material tested only: fresh plant material required!
NZ Tradescantia flow cytometry data

Comparison with Chinese spring wheat, *Triticum aestivum*

(34.6 pg, 2C value; Lee et al. 1997)

<table>
<thead>
<tr>
<th>taxa</th>
<th>ratio</th>
<th>2C value, in picograms</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. <em>albiflora</em></td>
<td>1:2.3</td>
<td>14.9</td>
</tr>
<tr>
<td>T. &quot;big leaves&quot;</td>
<td>1:2.3</td>
<td>14.9</td>
</tr>
<tr>
<td>T. <em>fluminensis</em></td>
<td>1:3.0</td>
<td>11.7</td>
</tr>
</tbody>
</table>
Approaching genetic diversity

• Sequence data analysis

• DNA content measurements

• Microsatellite markers
Microsatellites = Simple Sequence Repeats

Prior knowledge of whole genome required: Next Generation Sequencing

6 microsatellite markers identified for Tradescantia fluminensis (NZ)
SSR methodology

9 samples of Tradescantia (Brasil) with identical *trnL-F*
SSR methodology

9 samples of Tradescantia (Brasil) with identical *trnL-F*
Tradescantia SSR data

Tradescantia fluminensis (NZ) from outskirts of Curitiba, Brasil
TRADESCANTIA: WHO IS WHO?

- Three species of invasive *Tradescantia* in NZ identified via
  - DNA sequence: not diagnostic for weedy *Tradescantia* sp. in NZ, quick tool for foreign exploration
  - DNA content: *T. fluminensis* ≠ *T. big leaves/albiflora*
  - SSR markers: distinct genetic variation
- Native range of *T. fluminensis* (NZ) identified
TRADESCANTIA: FUTURE QUESTIONS

• Native range of T. albiflora, T. big leaves, and T. fluminensis?

• Breeding system, can these plants reproduce in other ways?

• How does this relate to other weed groups?
TAKE HOME MESSAGE

“happy”
plant material

High quality results
ACKNOWLEDGEMENTS

- Landcare Research Capability Fund
- Gary Houliston, Peter Heenan, Simon Fowler
- Lindsay Smith, Chris Winks
- Duckchul Park, Murray Dawson
MASTERING THE GENETIC VARIATION IN
TRADESCANTIA

T. big leaves, fluminensis, albiflora?