Landcare Research
Manaaki Whenua

Molecular identification of weeds: *Tradescantia*

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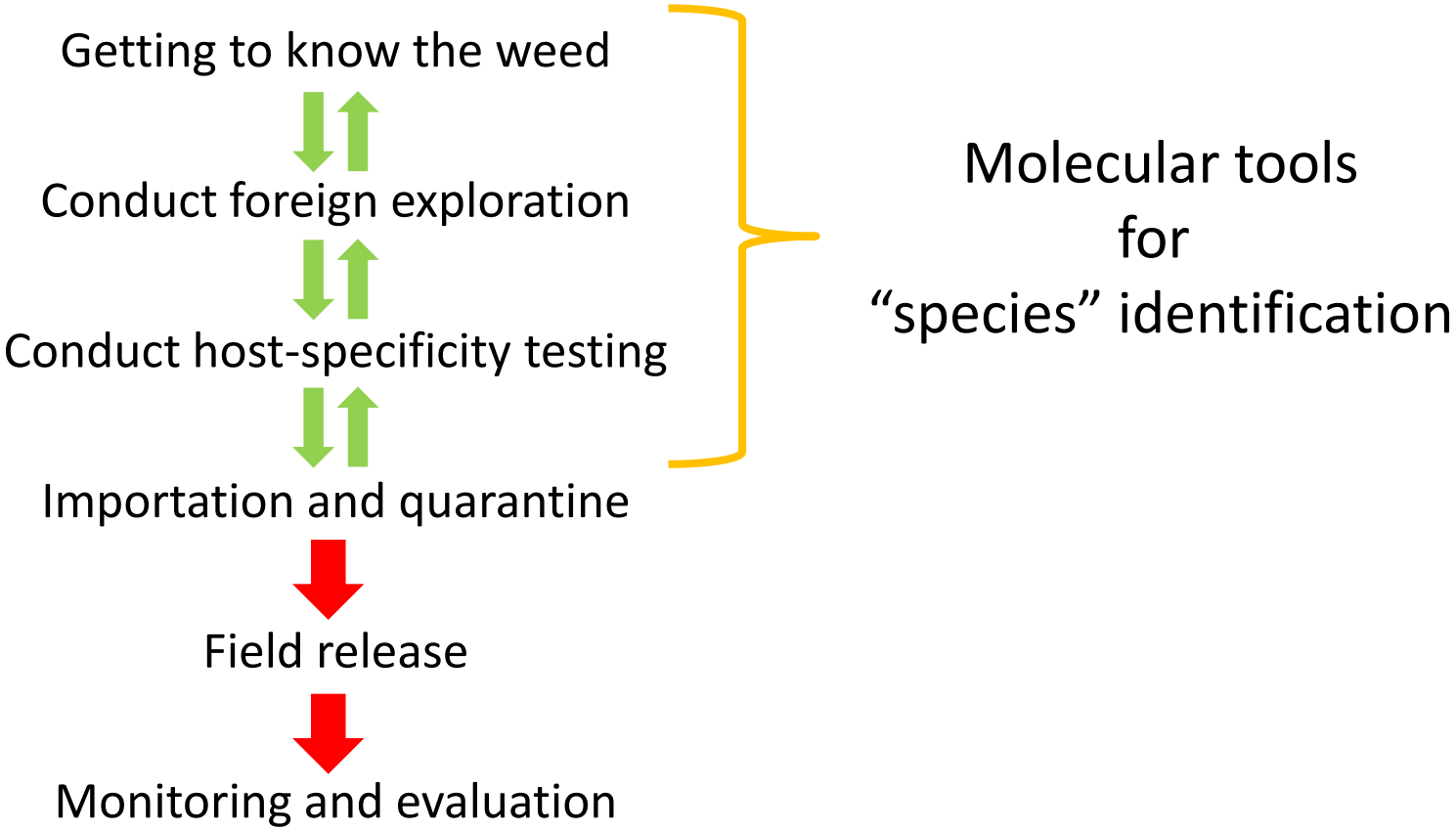
Ecological Genetics group

Landcare Research

Biosecurity Bonanza

Wellington, 6th June 2012

Biological control to beat weeds



Biological control to beat weeds

Getting to know the weed

Conduct foreign exploration

Conduct host-specificity testing

Importation and quarantine

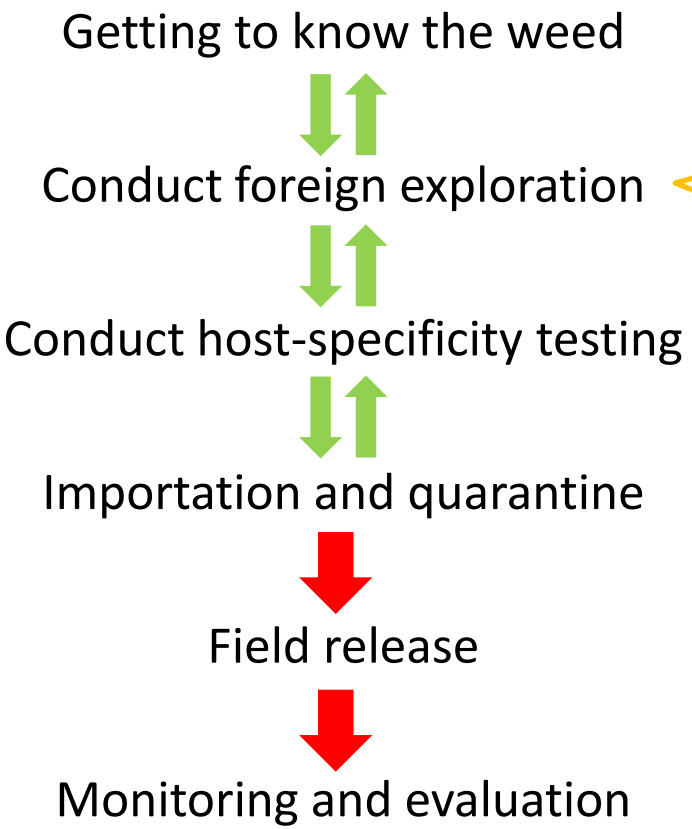
Field release

Monitoring and evaluation

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

T. big leaves, fluminensis, albiflora

Biological control to beat weeds



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)

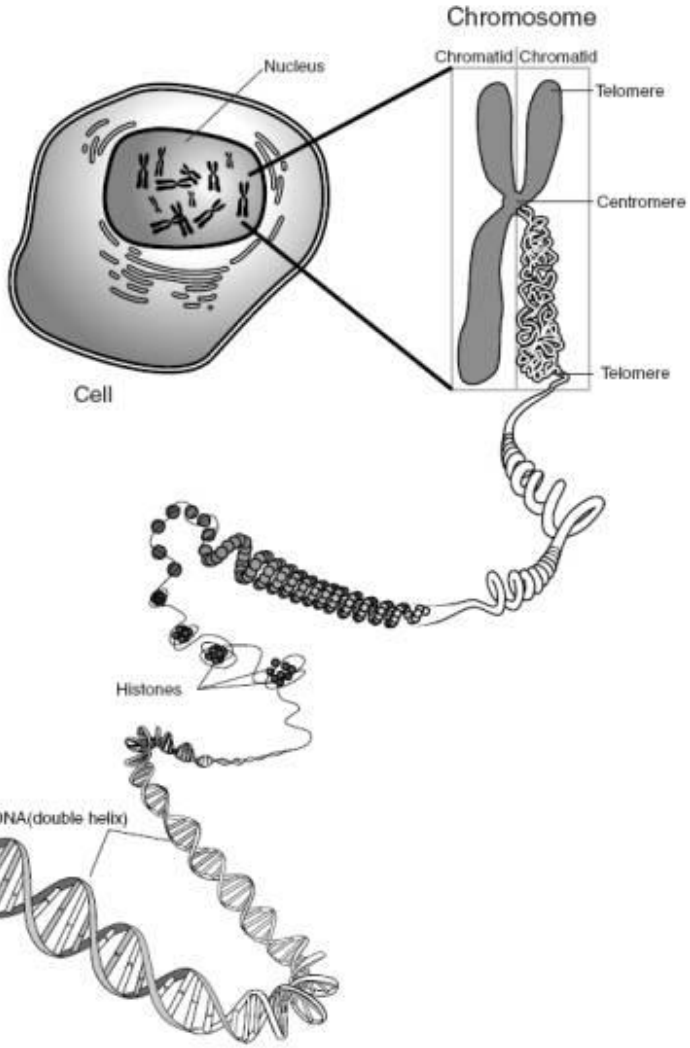
Phylogenetic hypothesis for 68 within the Commelinaceae family, including 17 out of about 70 Tradescantia species*

*Burns et al., 2009,
Phylogenetic Studies in the Commelinaceae Subfamily Commelinoideae Inferred from Nuclear Ribosomal and Chloroplast DNA Sequences, Systematic Botany, 36(2):268-276.

DNA extraction

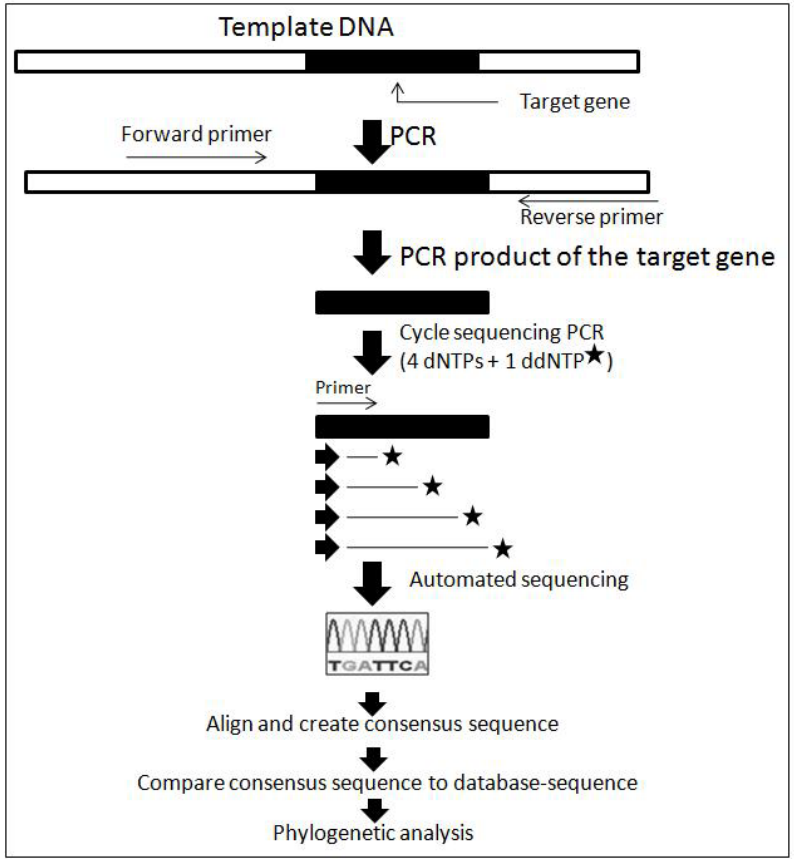
"happy" plant material

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,
Phylogenetic Studies in the Commelinaceae Subfamily Commelinoideae Inferred from Nuclear Ribosomal and Chloroplast DNA Sequences, Systematic Botany, 36(2):268-276.

Tradescantia DNA sequence data

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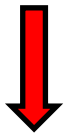


identical sequences for

invasive *Tradescantia* in NZ and 9 samples from Brasil

- NZ material: *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[1)]

Tradescantia: diploid – 22ploid (sets of chromosomes),

5-7 unique chromosomes, 12 - 132 in total[2)]

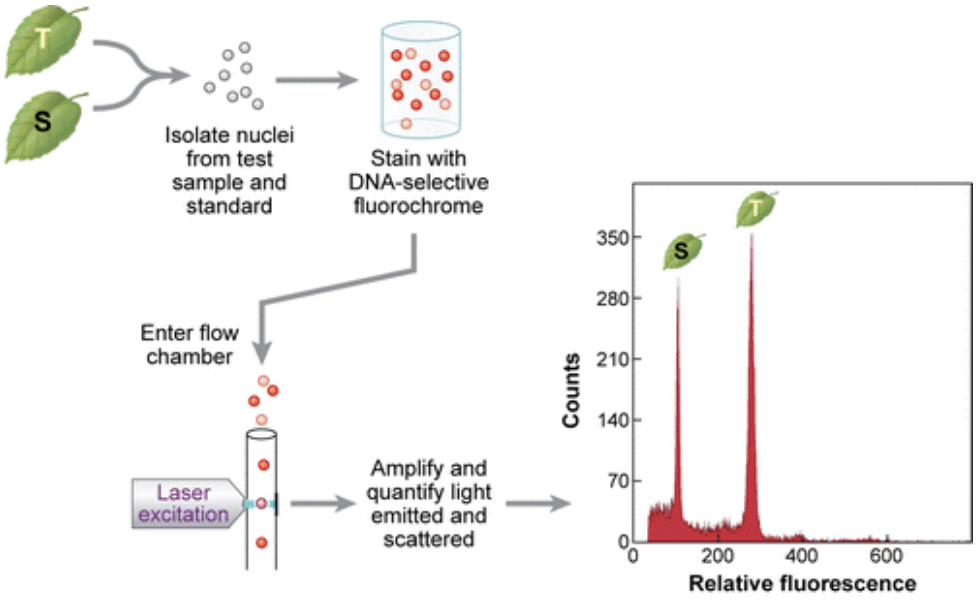
Humans: diploid, 23 unique chromosomes, 46 in total

1) Wood TE, Takebayashi N, Barker MS, Mayrose I, Greenspoon PB, Rieseberg LH, 2009, "The frequency of polyploid speciation in vascular plants", *Proc. Natl. Acad. Sci. U.S.A.* 106 (33): 13875–9.

2) DNA content in *Tradescantia,* Arturo Martínez and Héctor D. Ginzo, 1985, Canadian Journal of Genetics and Cytology, Vol. 27, No. 6 : pp. 766-775

Principle of flow cytometry

New Zealand material tested only: fresh plant material required !



Kron P, et al. 2007.
Annu. Rev. Ecol. Evol. Syst. 38:847–76

NZ Tradescantia flow cytometry data

Comparison with Chinese spring wheat, Triticum aestivum

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

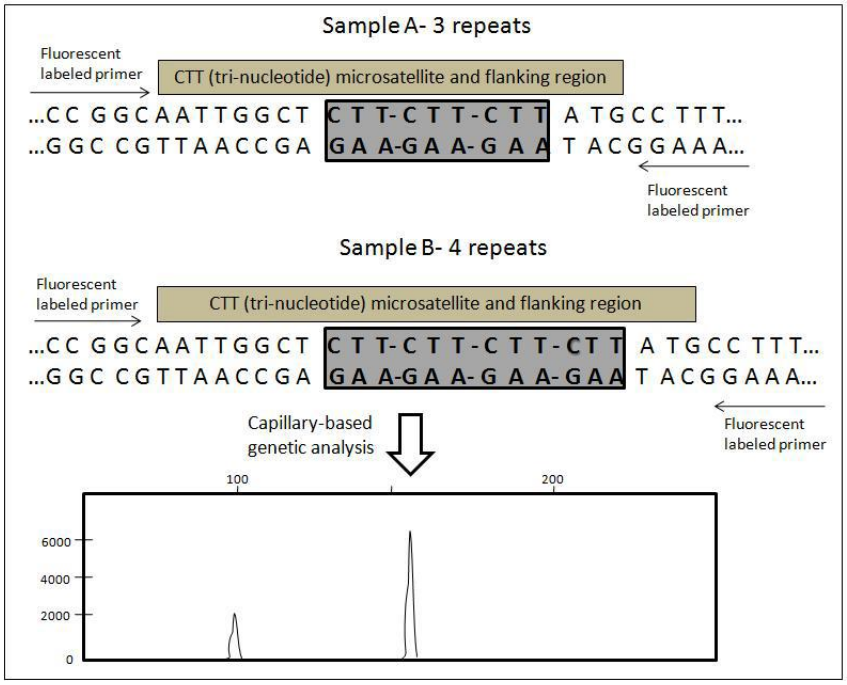
taxa	ratio	2C value, in picograms
T. albiflora	1:2.3	**14.9**
T. "big leaves"	1:2.3	**14.9**
T. fluminensis	1:3.0	**11.7**

Approaching genetic diversity

- Sequence data analysis
- DNA content measurements
- **Microsatellite markers**

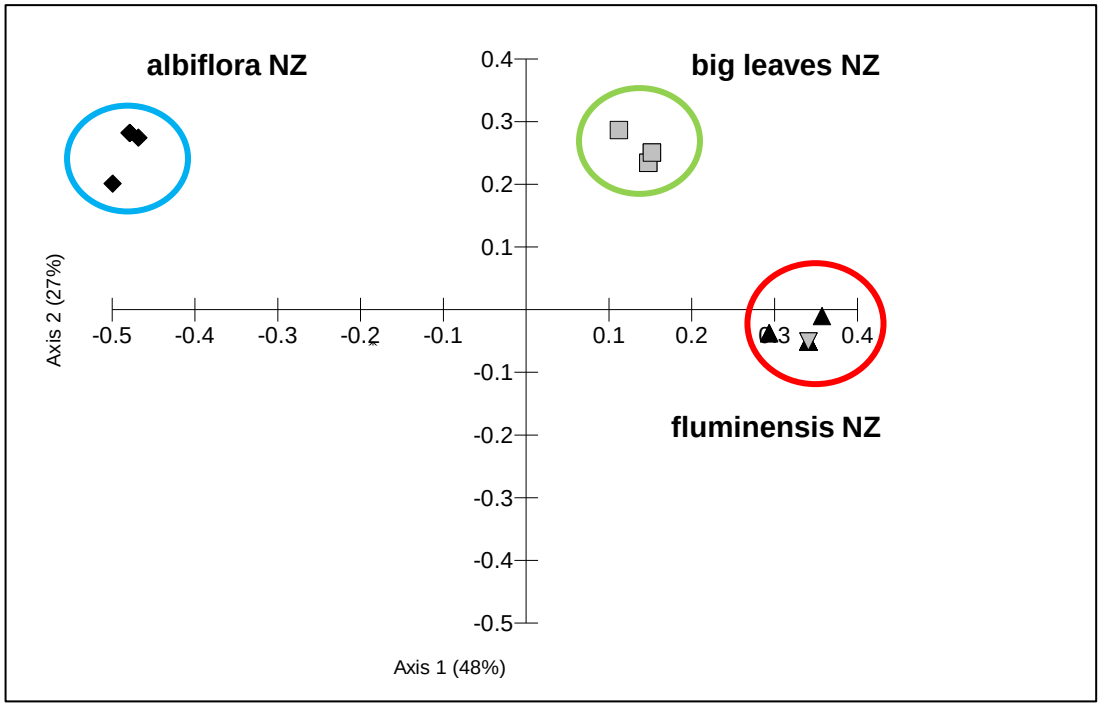
Microsatellites = Simple Sequence Repeats

Prior knowledge of whole genome required: *Next Generation Sequencing*



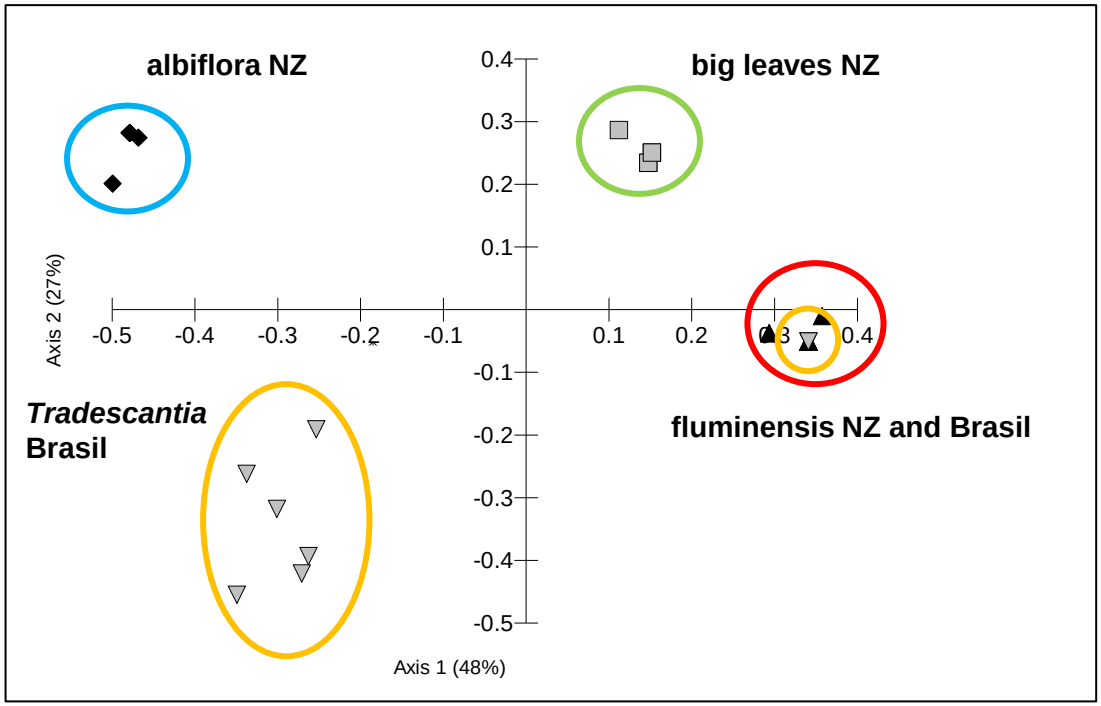
6 microsatellite markers identified for Tradescantia fluminensis (NZ)

SSR methodology



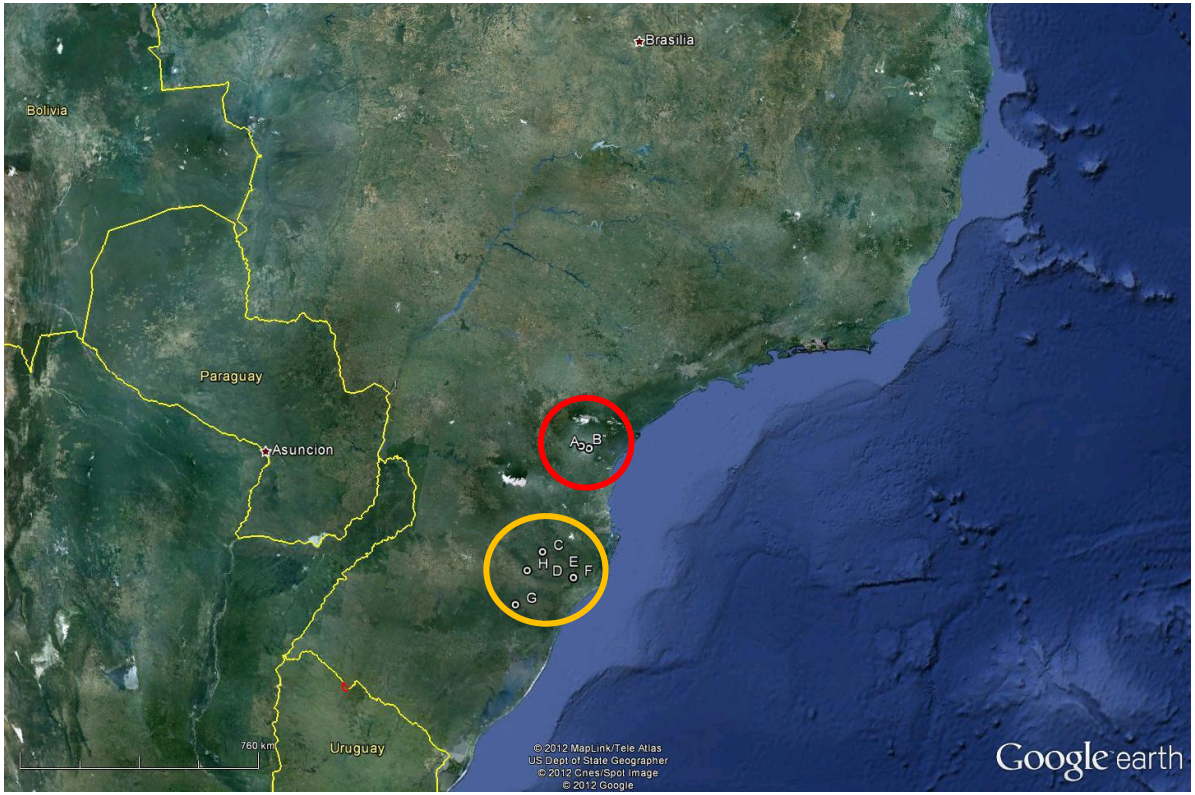
9 samples of Tradescantia (Brasil) with identical *trnL-F*

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 ?