



# Molecular evidence supporting the horticultural origin of invasive jubata grass (*Cortaderia jubata*)

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## Introduction

- Jubata grass is native to the Andes of Ecuador, Peru, Bolivia, and Argentina but has become invasive in California, Hawaii, New Zealand, Australia, and South Africa.
- In California, jubata grass invades ecologically sensitive coastal areas and is a pest in forestry operations.
- There are two morphologically similar invasive species of *Cortaderia*. Unlike the sexually reproducing and widely cultivated pampas grass (*C. selloana*), jubata grass reproduces asexually by seed (apomixis) and has a limited history of cultivation.
- Seed of jubata grass collected in Chimborazo, Ecuador was first brought into cultivation in Nancy, France around 1876.
- A horticultural origin has been hypothesized for invasive jubata grass in California.

## Objectives

- Characterize the genotypic diversity and structure in invasive and native jubata grass.
- Identify the native geographic origin of invasive jubata grass.
- Test the hypothesis of the horticultural origin of invasive jubata grass.

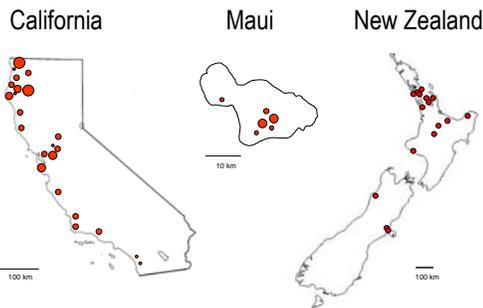


Fig. 1 Map of California, Maui, and New Zealand showing the sampling locations of invasive jubata grass.



Fieldwork, Genotyping & Location of Invasive Populations: Joe DiTomaso • Riaz Ahmad • Jeff Firestone • Cindy Yip • Chris Mallek • Anna Sherwood • Maui Invasive Species Committee • John Lambrinos • California Academy of Sciences Herbarium • Rancho Santa Ana Botanical Garden Herbarium • University of California Davis Herbarium  
Loan of Herbarium Specimens: Auckland War Memorial Museum • Field Museum of Natural History • Göteborg University • Landcare Research New Zealand • New York Botanical Garden • New Zealand Forest Research Institute • University of Aarhus • University of Hamburg

Funded by UC Exotic/Invasive Pests and Diseases Program

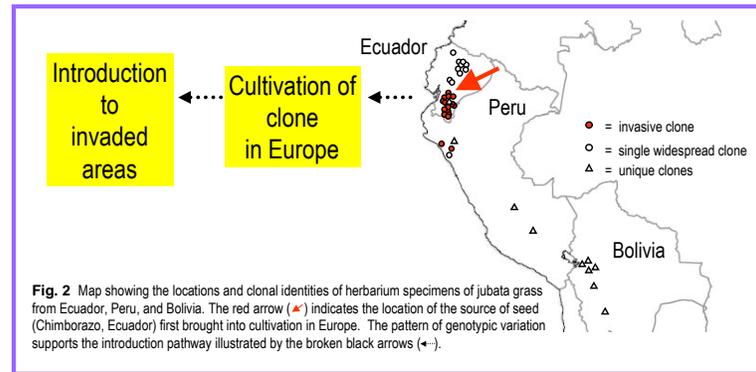


Fig. 2 Map showing the locations and clonal identities of herbarium specimens of jubata grass from Ecuador, Peru, and Bolivia. The red arrow (★) indicates the location of the source of seed (Chimborazo, Ecuador) first brought into cultivation in Europe. The pattern of genotypic variation supports the introduction pathway illustrated by the broken black arrows (←).

## Materials and Methods

- Sampling of invasive jubata grass included 23 populations from California (233 plants), 6 populations from Hawaii (28 plants), and 16 herbarium specimens from New Zealand (Fig. 1)
- Sampling of native jubata grass consisted of 83 herbarium specimens from Ecuador, Peru, and Bolivia (Fig. 2).
- Eight microsatellite primer pairs developed for *C. selloana* were used for genotyping.
- Genotypic variation was analyzed using GENOTYPE/GENODIVE (Meirmans & Van Tienderen 2004)

## Results

- The 8 primer pairs amplified an average of 17 alleles per genotype (range of 13-22) among all the samples.
- Analysis of pairwise distances between genotypes revealed two groups of distance classes (smaller and larger) among native genotypes as expected from the presence of multiple clones, whereas the absence of larger distance classes from the invasive genotypes indicates that they consist of a single clone (Fig. 3).
- Assignment of genotypes to clone mates at the threshold pairwise distance (Fig. 3) resulted in identification of 14 clones among native jubata grass (Table 1)
- There were two widespread clones in South America (Fig. 2). One widespread clone was found mainly in northern Ecuador with a disjunct distribution in northern Peru. The other widespread clone was found in southern Ecuador/northern Peru. Unique genotypes were found in southern Ecuador through Bolivia.
- The widespread clone found in southern Ecuador/northern Peru matched the invasive genotype.

## Conclusions

- Invasive jubata grass in California, Hawaii, and New Zealand consists of a single clone.
- The clonal genotype of invasive jubata grass matched the native clonal genotype found in southern Ecuador/northern Peru.
- Distribution of this clone in the native region included the source location of seed first brought into cultivation.
- The pattern of genotypic variation in invasive and native jubata grass is consistent with introduction of the cultivated clone to invaded areas via Europe.

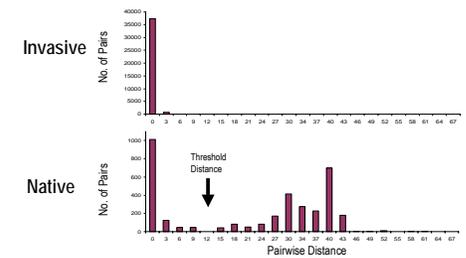


Fig. 3 Histograms showing the number of pairs for each pairwise distance class in invasive (above) and native (below) jubata grass genotypes. The threshold distance was used to assign genotypes into clone mates.

Table 1 Clonal diversity in invasive (California, Hawaii, & New Zealand) and native (South America) jubata grass analyzed using the programs GENOTYPE & GENODIVE (Meirmans & Van Tienderen 2004).

	Sample size	Number of genotypes	Number of clones	Clonal diversity
California	233	8	1	0
Hawaii	28	1	1	0
New Zealand	16	5	1	0
South America	83	21	14	0.63

