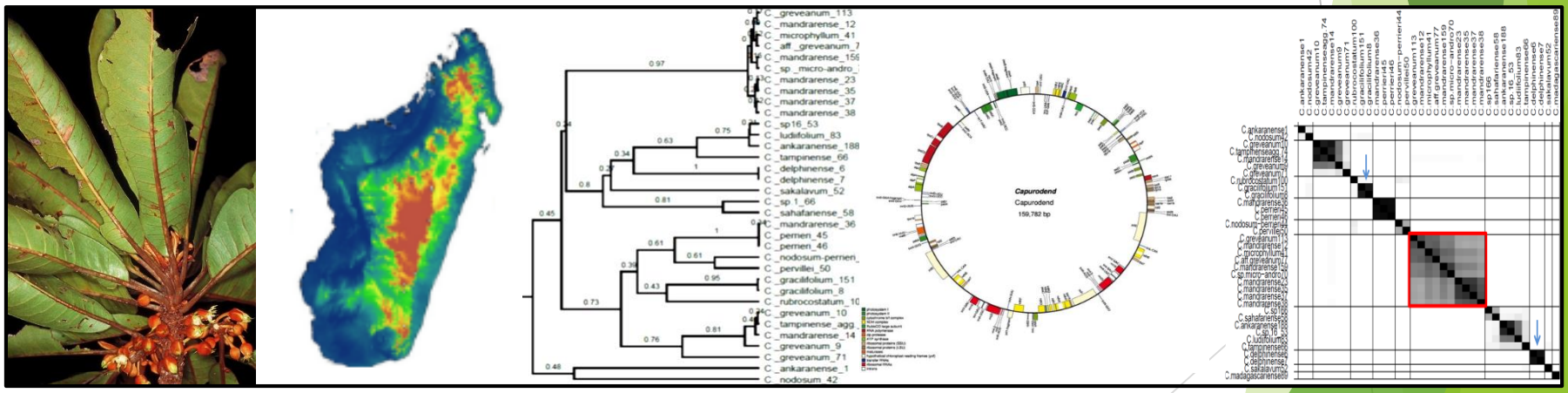
A race against the extinction of *Capurodendron* trees in Madagascar: from phylogenomic diversity to conservation.

Carlos G. Boluda, Camille Christe, Laurent Gautier & Yamama Naciri

Conservatoire et Jardin botaniques de la Ville de Genève



Biology19 meeting, University of Zurich-Irche, 8-Feb-2019

Conservatoire et Jardin botaniques Genève

FNSNF Swiss National Science Foundation

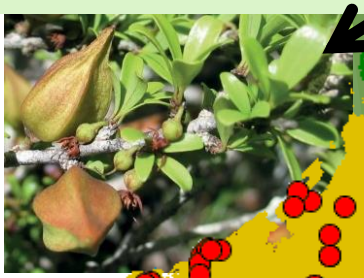
Université de Genève

Fondation Ernst et Lucie Schmidheiny

Introduction

Genus *Capurodendron*:

- Sapotaceae family.
- Third-largest endemic genus in Madagascar (26 spp).
- Trees, rarely shrubs.
- From rainforests to arid lands.
- Critically endangered (deforestation + precious wood).
- Flowers homogeneous across species.
- Leaves, fruits and seeds characters variable.



C. sahafariense

C. schatzii

C. greveanum

C. androyense

C. delphinense

C. tampinense

Madagascar climatic map

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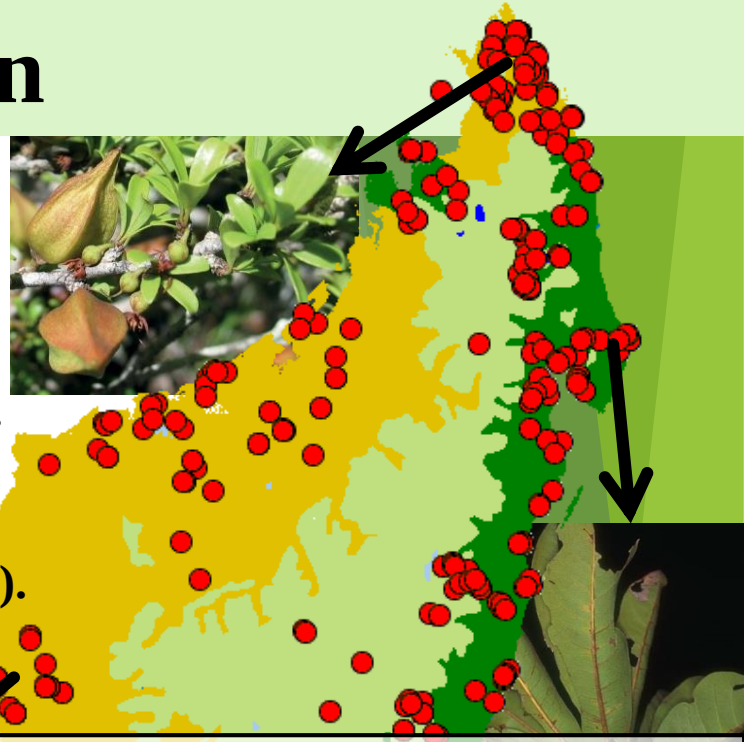

C. sahafariense

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Possibly extinct *Capurodendron* species

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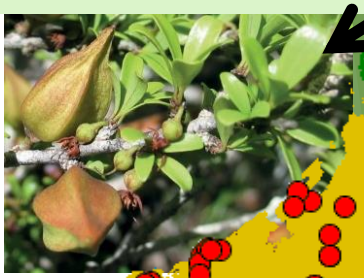

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Madagascar climatic map

Introduction

Genus *Capurodendron*:

Undescribed morphologies

Intermediate morphologies

Morphological species complexes

Undescribed species
Hybridization
Current speciation
?

C. delphinense

C. greveanum

C. androyense

C. sahafariense

C. schatzii

C. tampinense

Madagascar climatic map

Introduction

Main objectives:

- 1° Delimit the *Capurodendron* species using phylogenomics.

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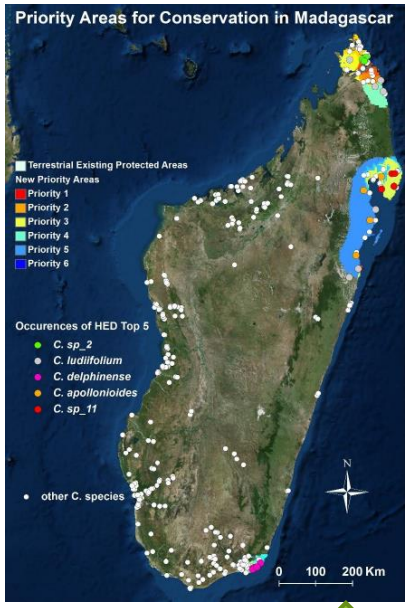
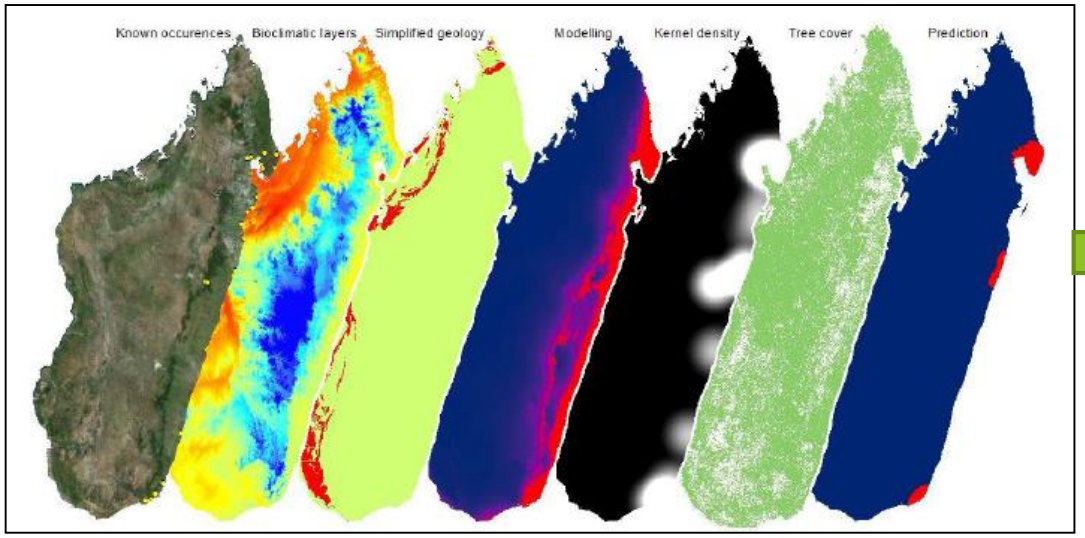
- 1° Delimit the *Capurodendron* species using phylogenomics.

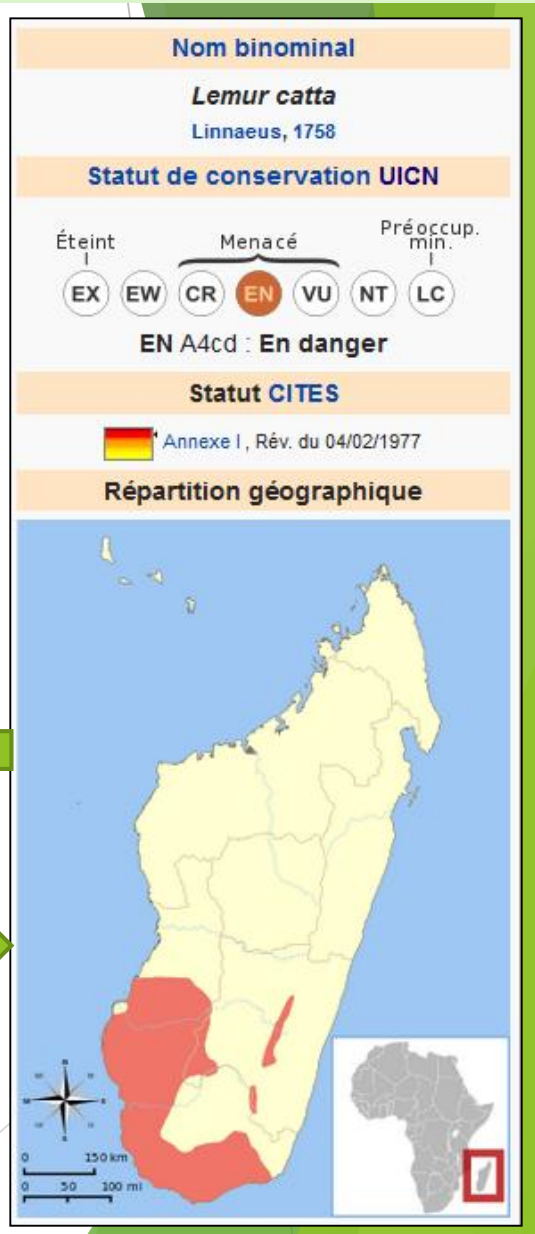
- 2° Estimate the species potential distribution and establish IUCN protection categories.



Priority areas for conservation



Climatic, geographical, dispersal, … map layers



Potential distribution, IUCN categories

Matterials and Methods

Sequences obtention:

Fresh specimens **Up to 80 years old specimens**

281 specimens:
239 ingroup
42 outgroup

Library construction

Matterials and Methods

Sequences obtention:

GenBank Transcriptome

Manilkara zapota

Newly sequenced incomplete genomes

Bemangidia lowryi
81 million reads
20x – 40x

Capurodendron delphinense
51 million reads
2x – 20x

Baits design

Fresh specimens **Up to 80 years old specimens**

Baits for 1020 loci
793 genes
227 microsatellites

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Library construction

Baits: small DNA sequences complementary to a target loci that allow us to capture these loci from a genomic DNA solution thorough an hybridization steep.

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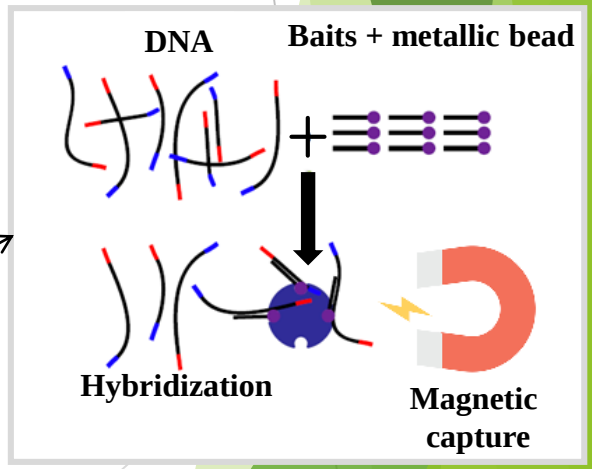
Gene Capture

Captured loci



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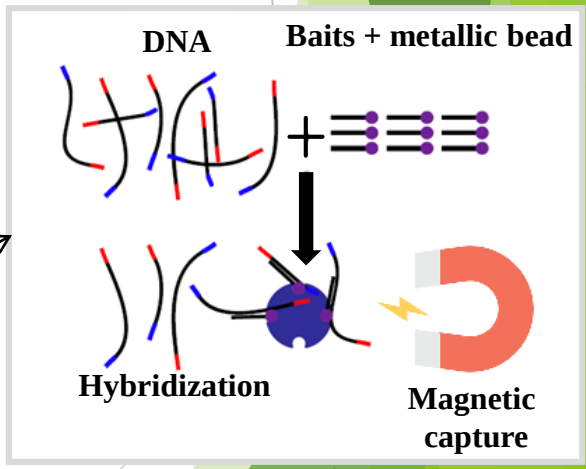
Illumina sequencing

Sequences for phylogenomic analyses



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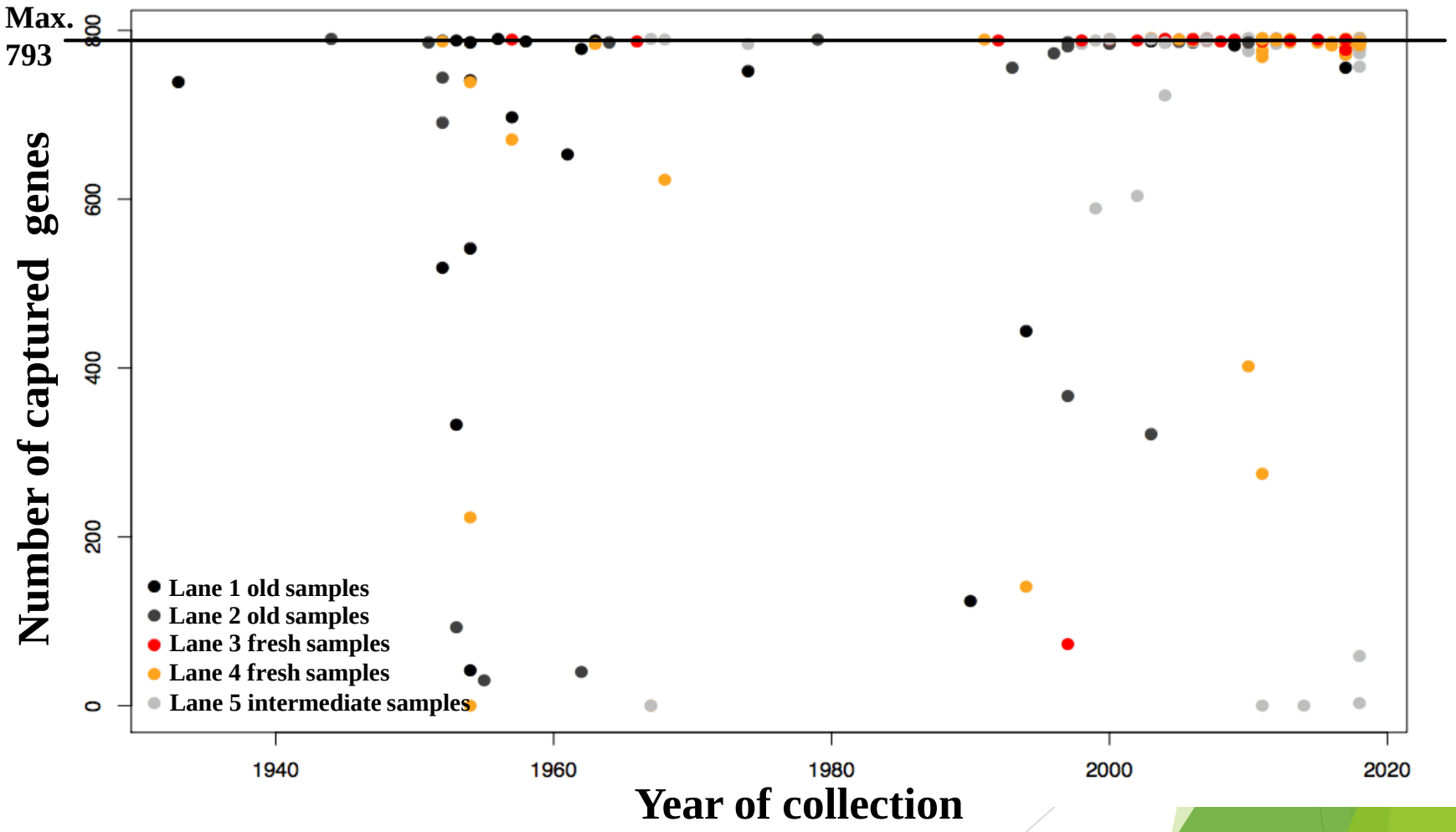
Preliminary results

Gene Capture efficency



Gene Capture is efficient in fresh and old samples

Preliminary results

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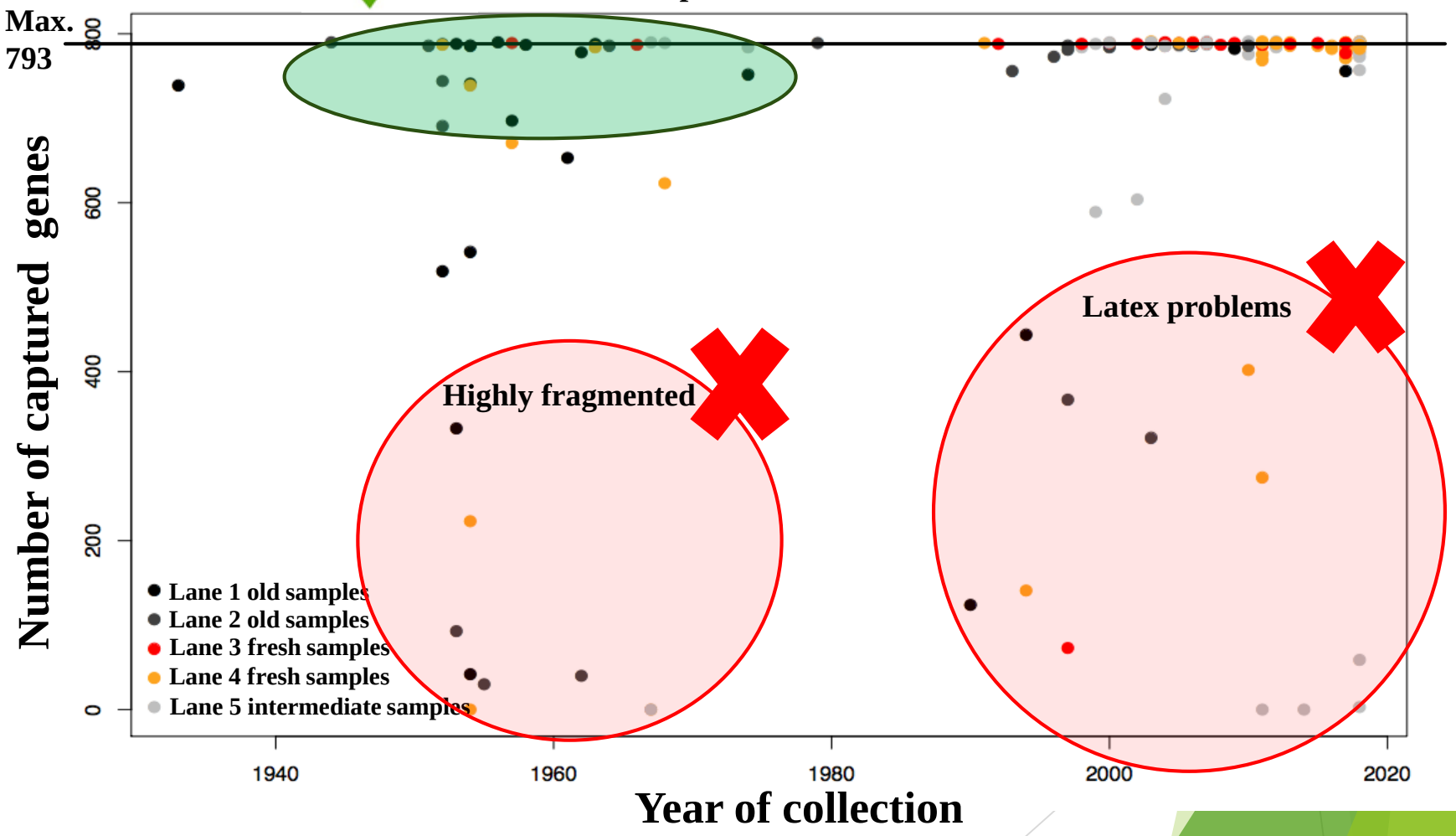

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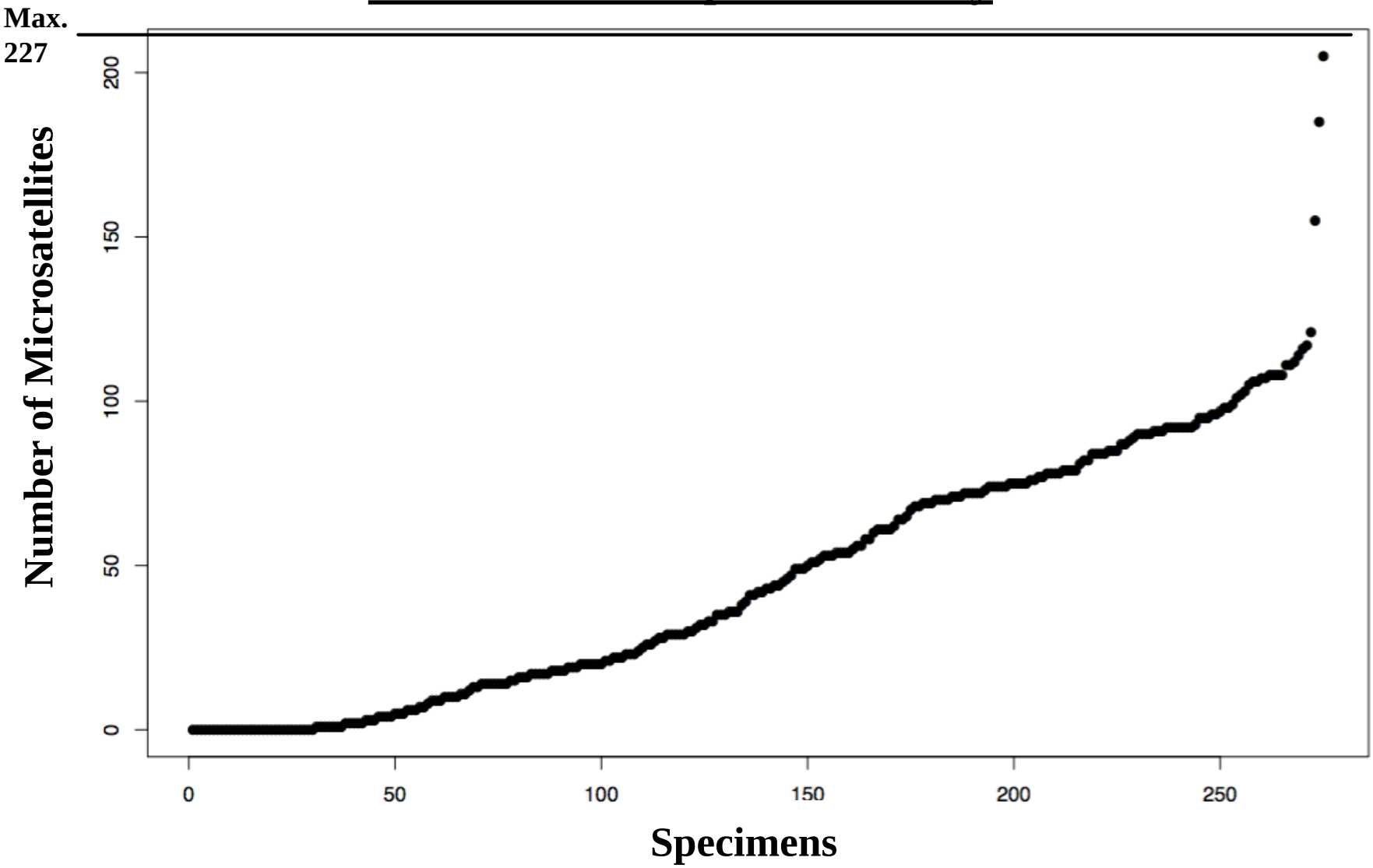
Preliminary results

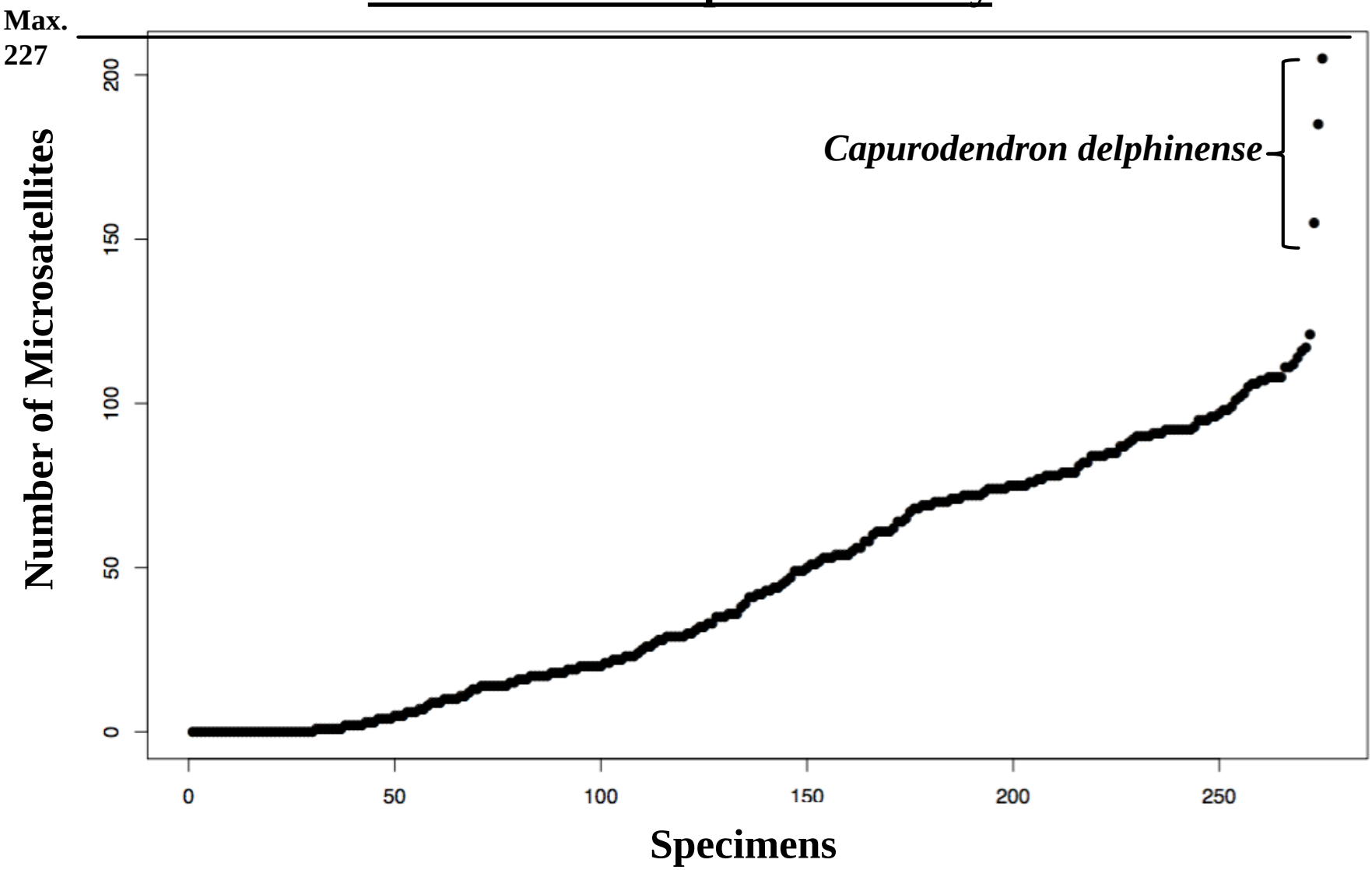
Microsatellite Capture efficency



Less efficient than Gene Capture → Highly variable sequences

Preliminary results

Microsatellite Capture efficency



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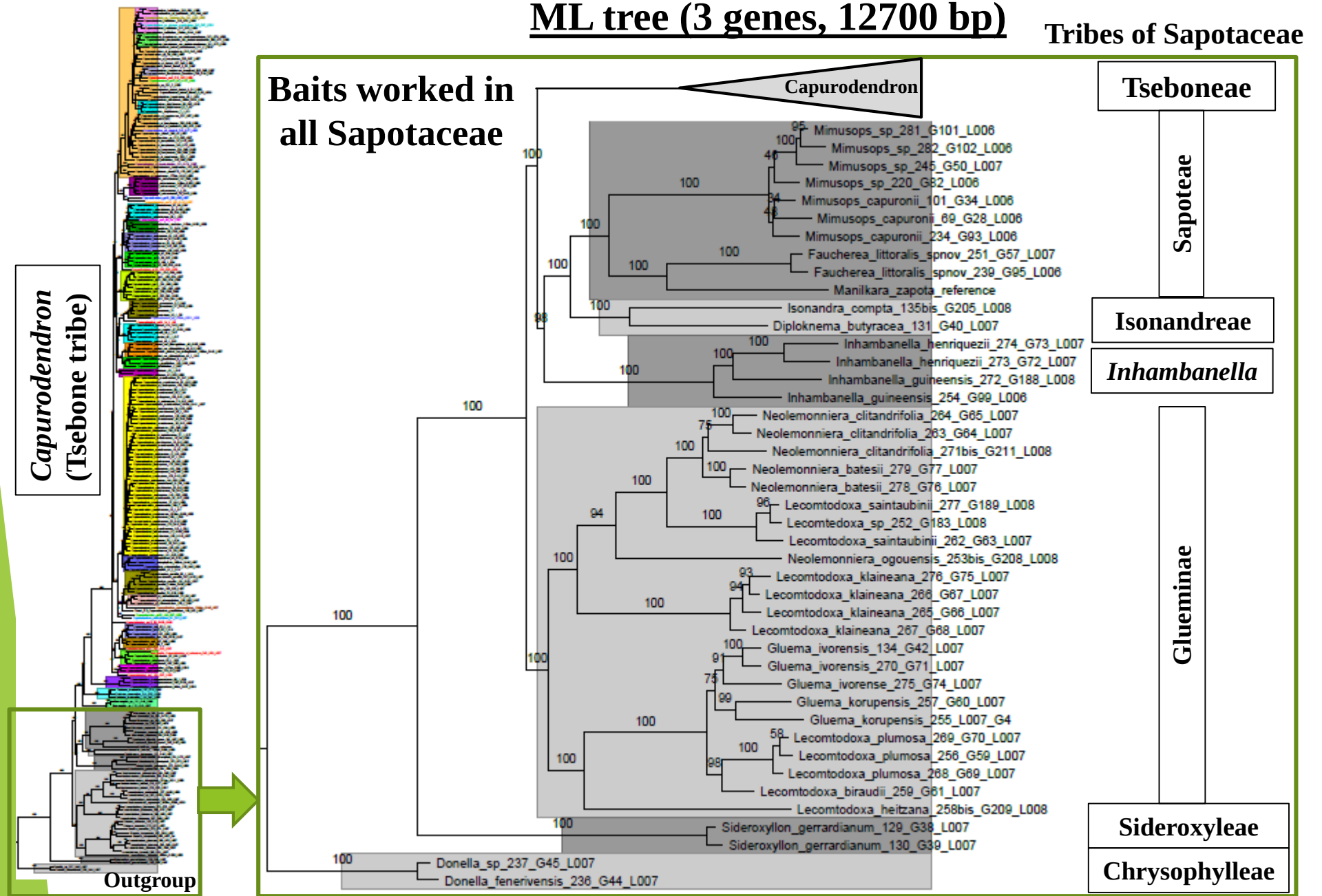
Preliminary results

ML tree (3 genes, 12700 bp)



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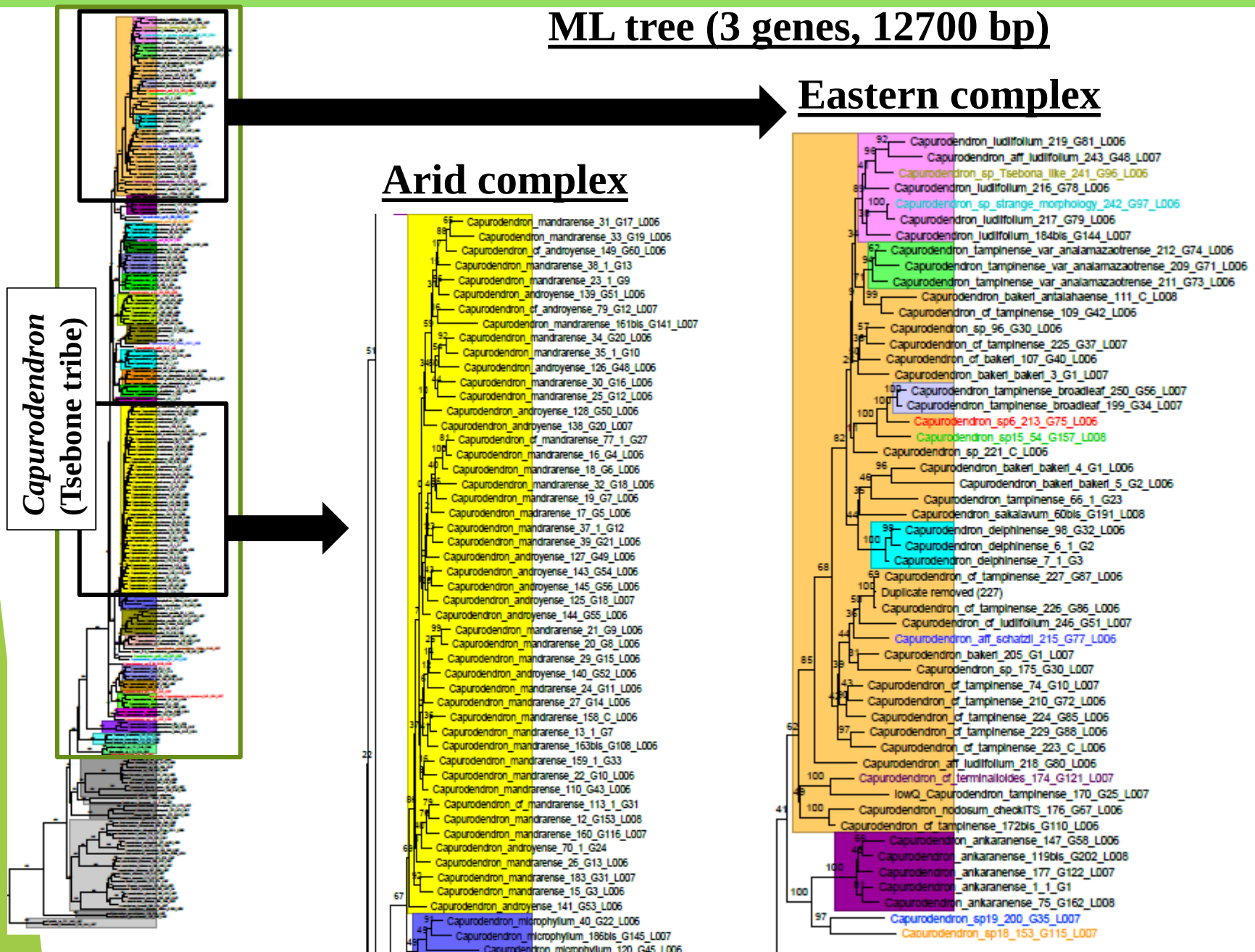

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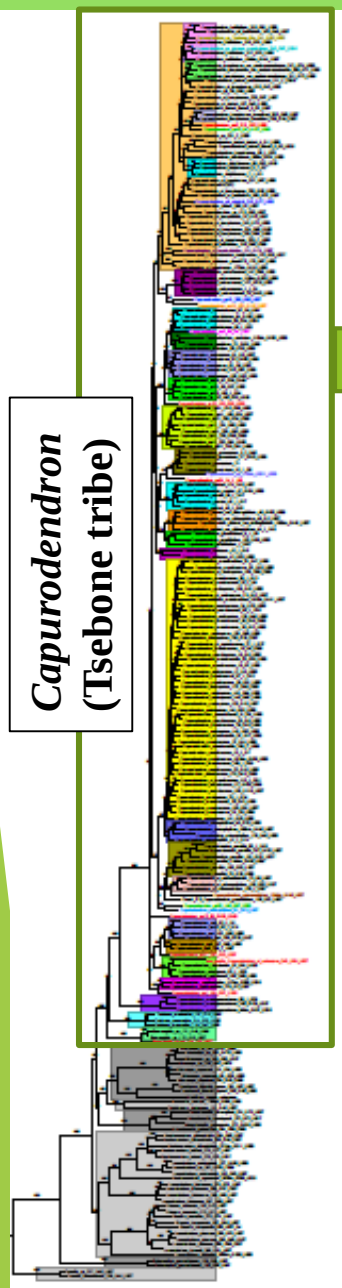

ML tree (3 genes, 12700 bp)

~ 49 clades candidate to species

Preliminary results

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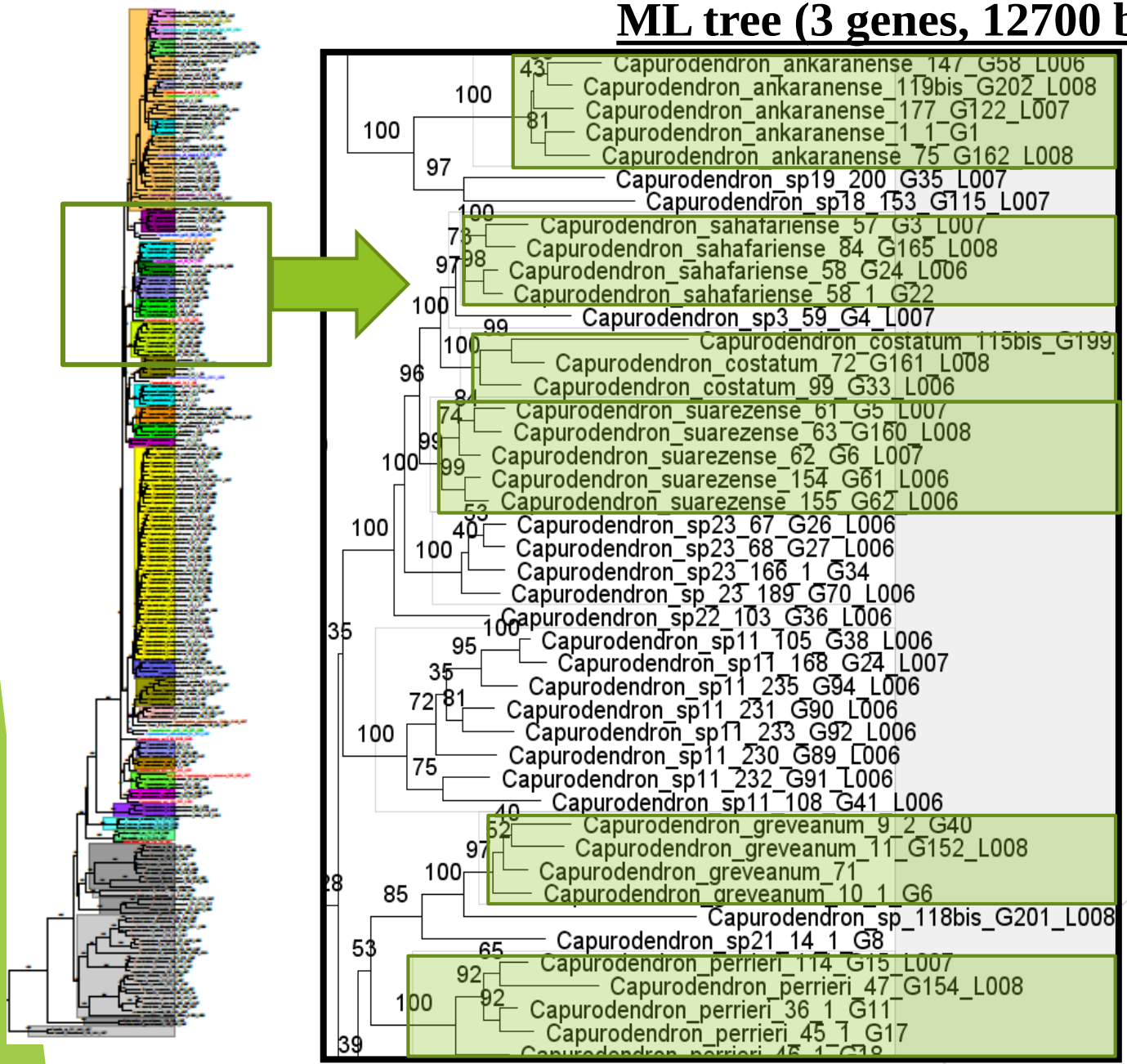

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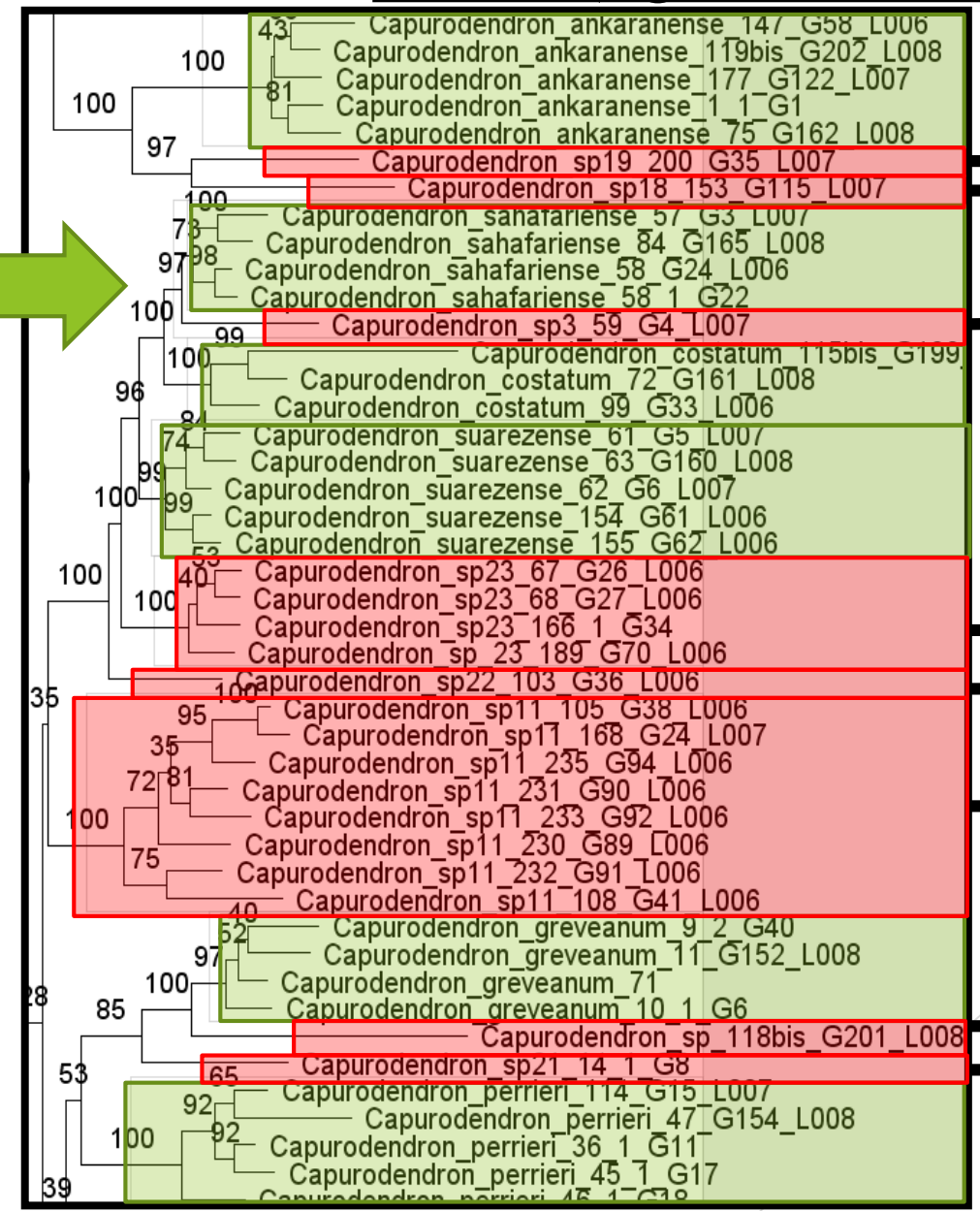

25 candidates to new species

sp. nov. ?

sp. nov. ?

sp. nov. ?

sp. nov. ?

sp. nov. ?

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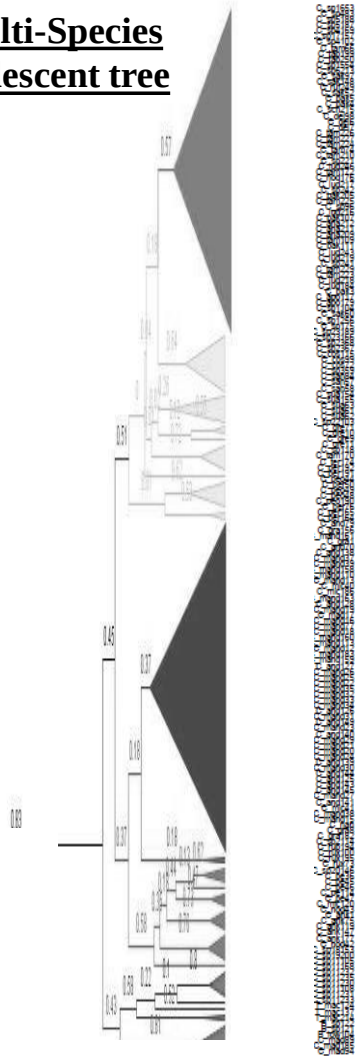
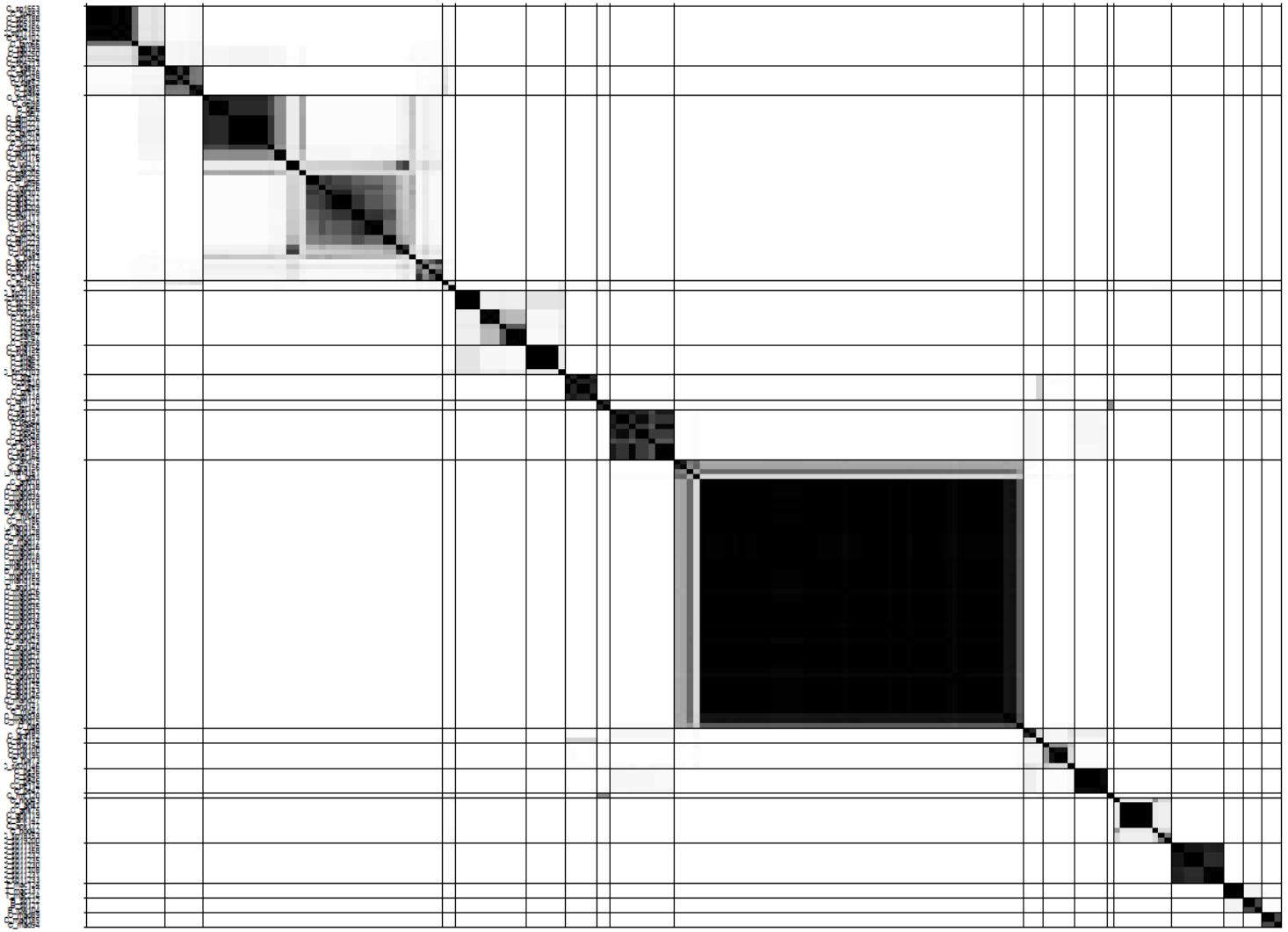
sp. nov. ?

Preliminary results

STACEY species delimitation analysis

Multi-Species coalescent tree





Putative species are shown in black squares

Conspecificity: 0% 50% 100%

Preliminary results

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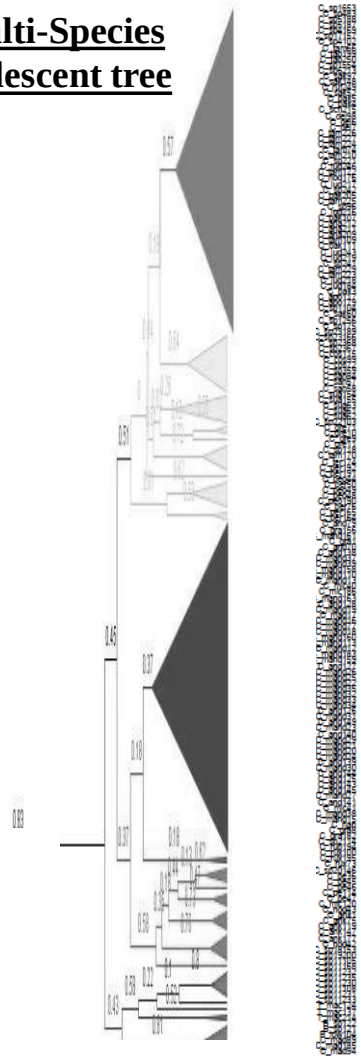

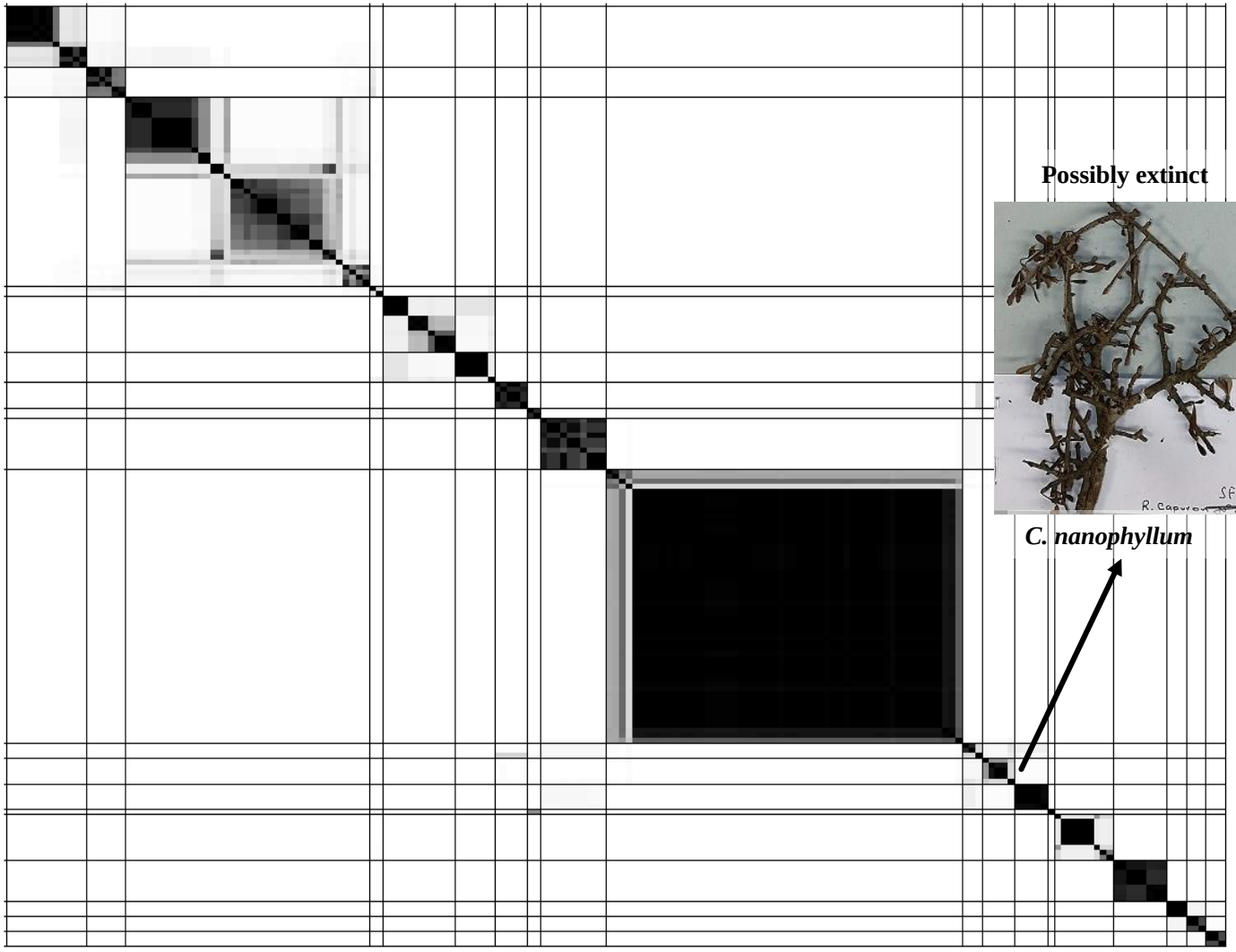

Possibly extinct

C. nanophyllum

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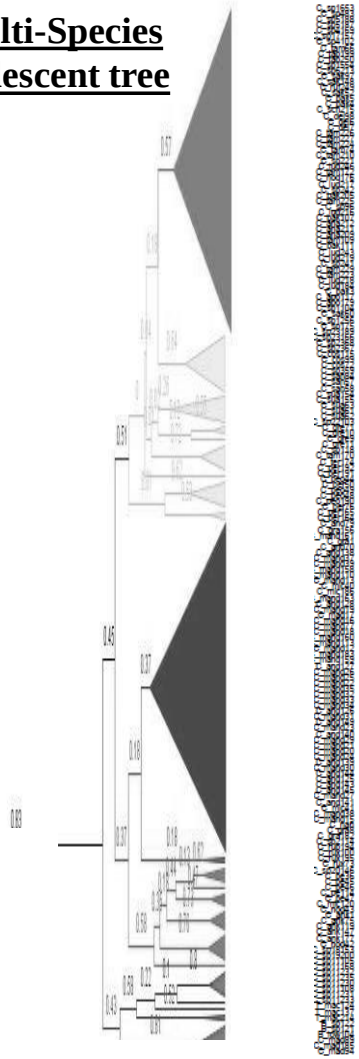

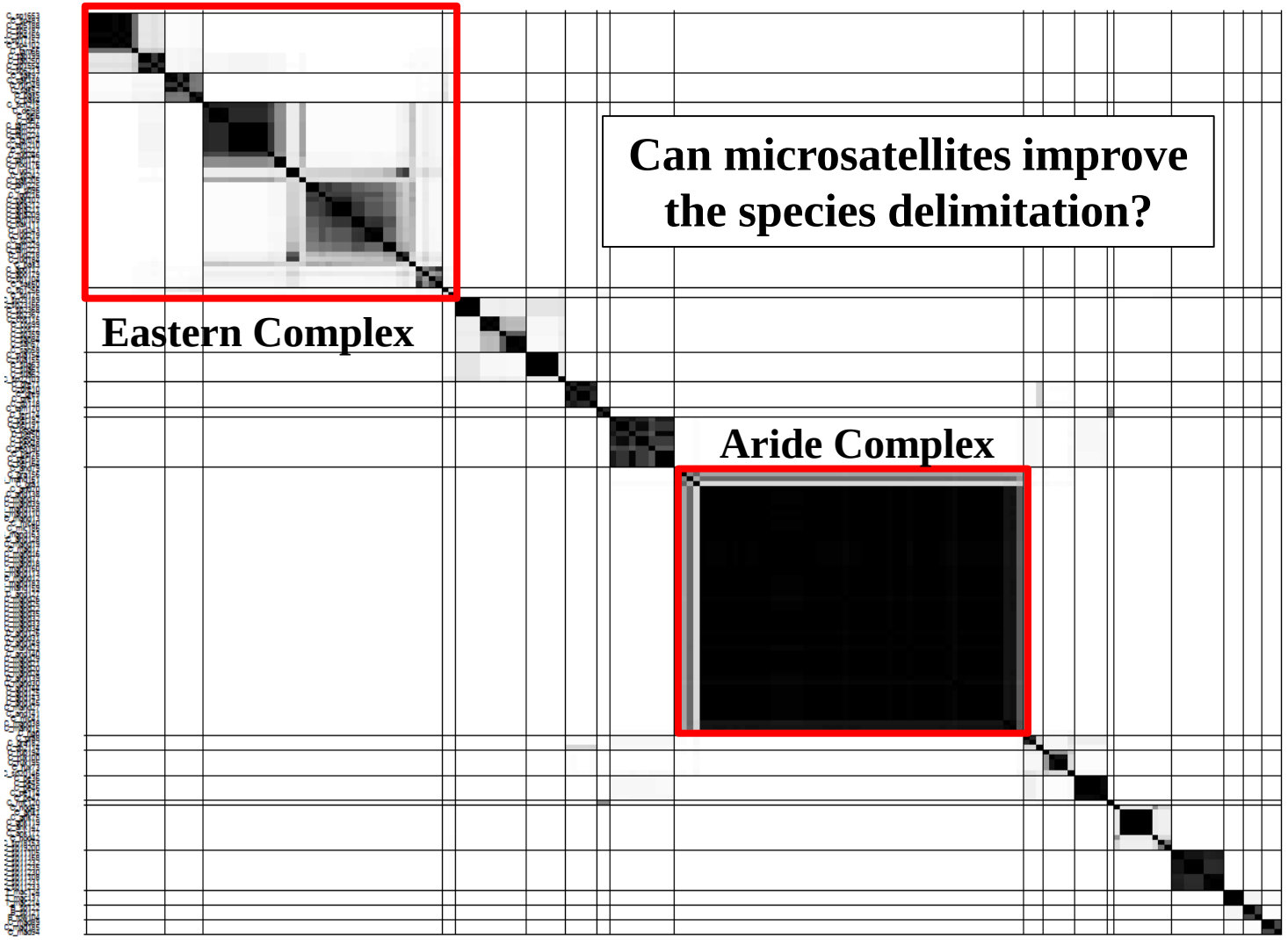

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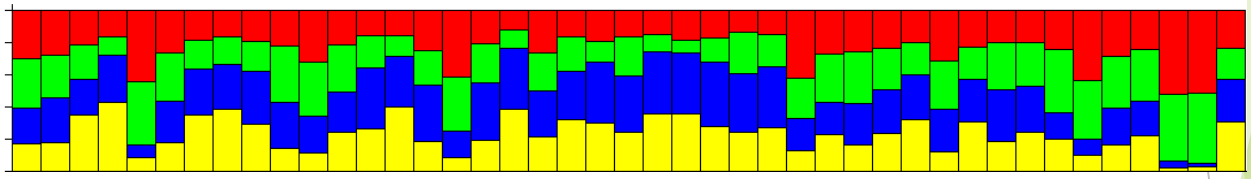
Preliminary results

Preliminar species delimitation using microsatellites

Using 30 microsatellites and Bayesian analyses:

- **Arid Complex: One "species".**



STRUCTURE analysis at K4

Capurodendron mandrarense

Conspecific???

Hybridization???

Capurodendron androyense

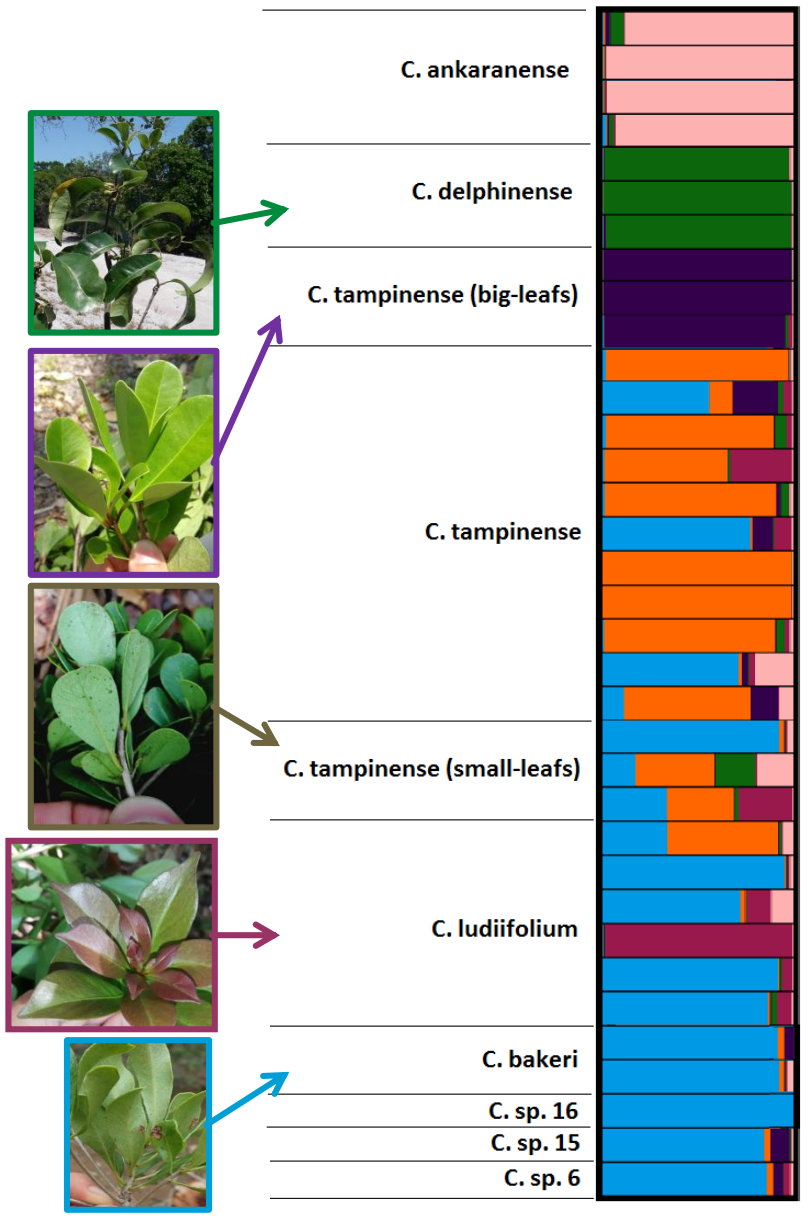
Preliminary results

Preliminar species delimitation using microsatellites

Using 30 microsatellites and Bayesian analyses:

- **Eastern complex: Species group with high levels of admixture**

Unbalanced sampling sizes
Hybridization???



STRUCTURE results of part of the Eastern Complex

Preliminar Conclusions

- **Gene capture works well in all Sapotaceae and even with old herbarium specimens**
- ***Capurodendron* contains much more species than initially thought**
- **Two species complexes with a mismatch between phenotypes and genotypes: Hybridization or incomplete lineage sorting?**
- **Microsatellites might not be as useful as expected**

Acknowledgements

Yamama Naciri

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Thank you!