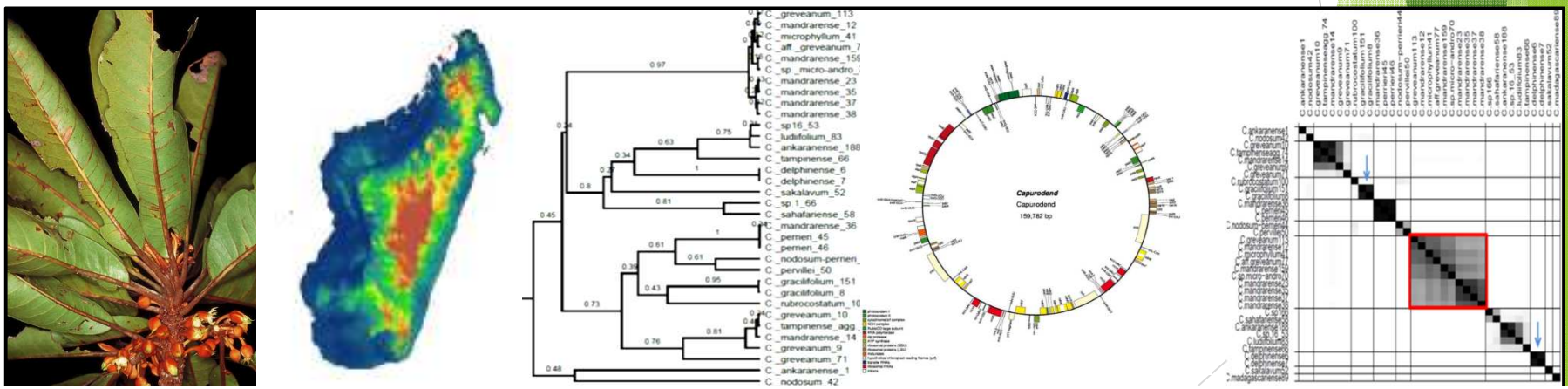
Phylogenomics and species conservation of the family Sapotaceae in Madagascar, a race against extinction

Carlos G. Boluda

Laboratoire de systématique et diversité, Prof. Michelle Price

Camille Christe, Aina Randriarisoa, Yamama Naciri & Laurent Gautier



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UNIVERSITÉ DE GENÈVE

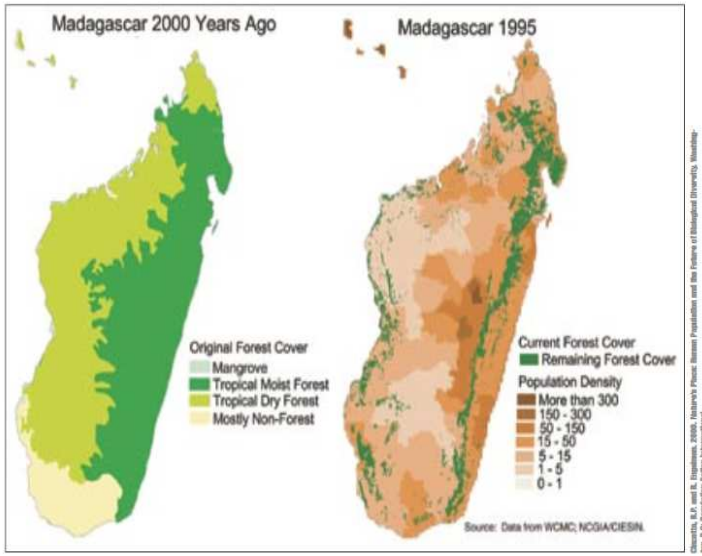
19-September-2022

Introduction

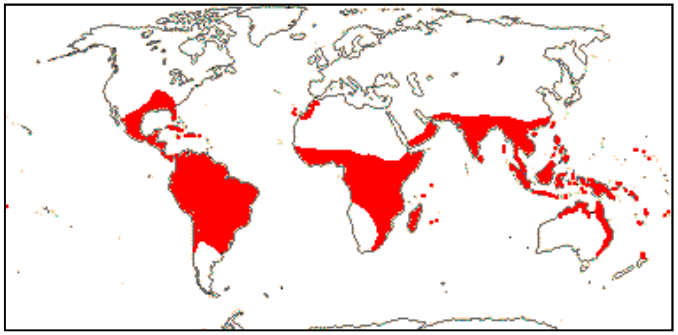
Madagascar:

~ 90 % of endemism in Angiosperms

~ 90 % of the original forest has been lost.



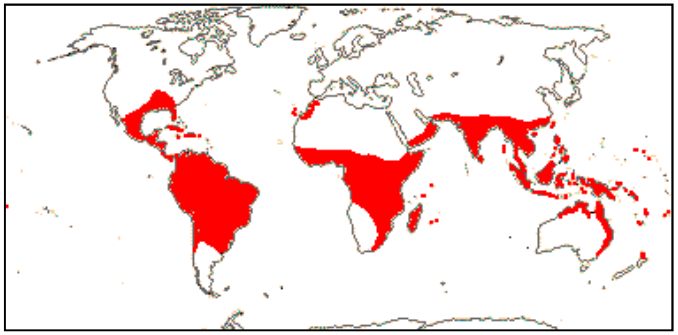
The Sapotaceae family:



- **Tropical trees.**
- **Appreciated timber.**
- **Slow growing trees from undisturbed areas**
- **Highly represented in Madagascar (10% of Sapotaceae species worldwide).**
- **Poorly studied in Madagascar.**

Introduction

The Sapotaceae family:



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Introduction

Genus	Tribe
Gambeya	Chrysophylleae
Donella	
Sideroxylon	Sideroxyleae
Mimusops	Sapoteae
Manilkara	
Labramia	
Labourdonnaisia	
Faucherea	
Capurodendron	Tseboneae
Tsebona	
Bemangidia	

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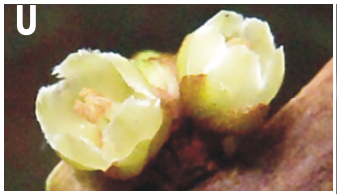

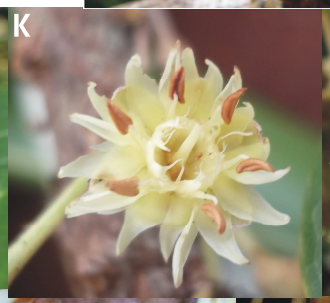

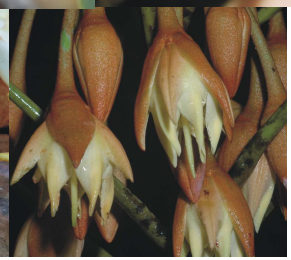

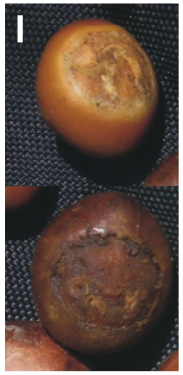

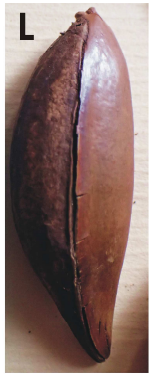

Introduction

Genus

Gambeya
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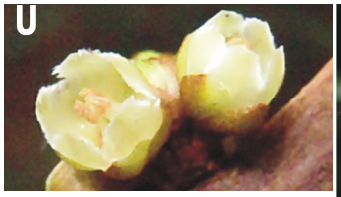
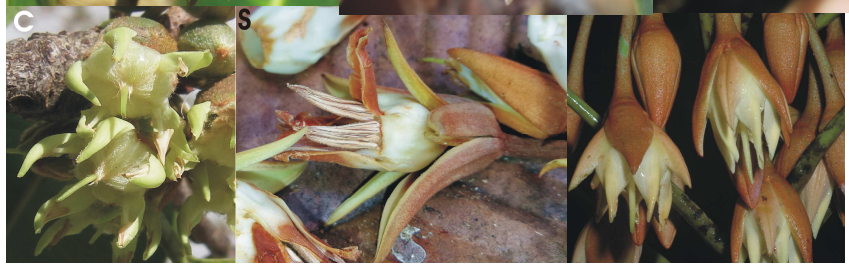
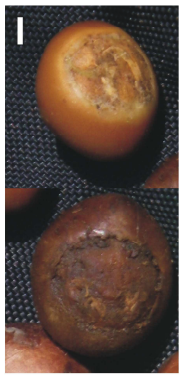
Capurodendron
Tsebona
Bemangidia

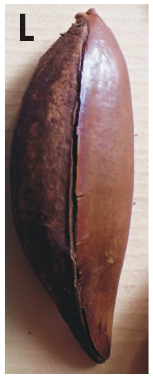
Sideroxyleae



Tseboneae







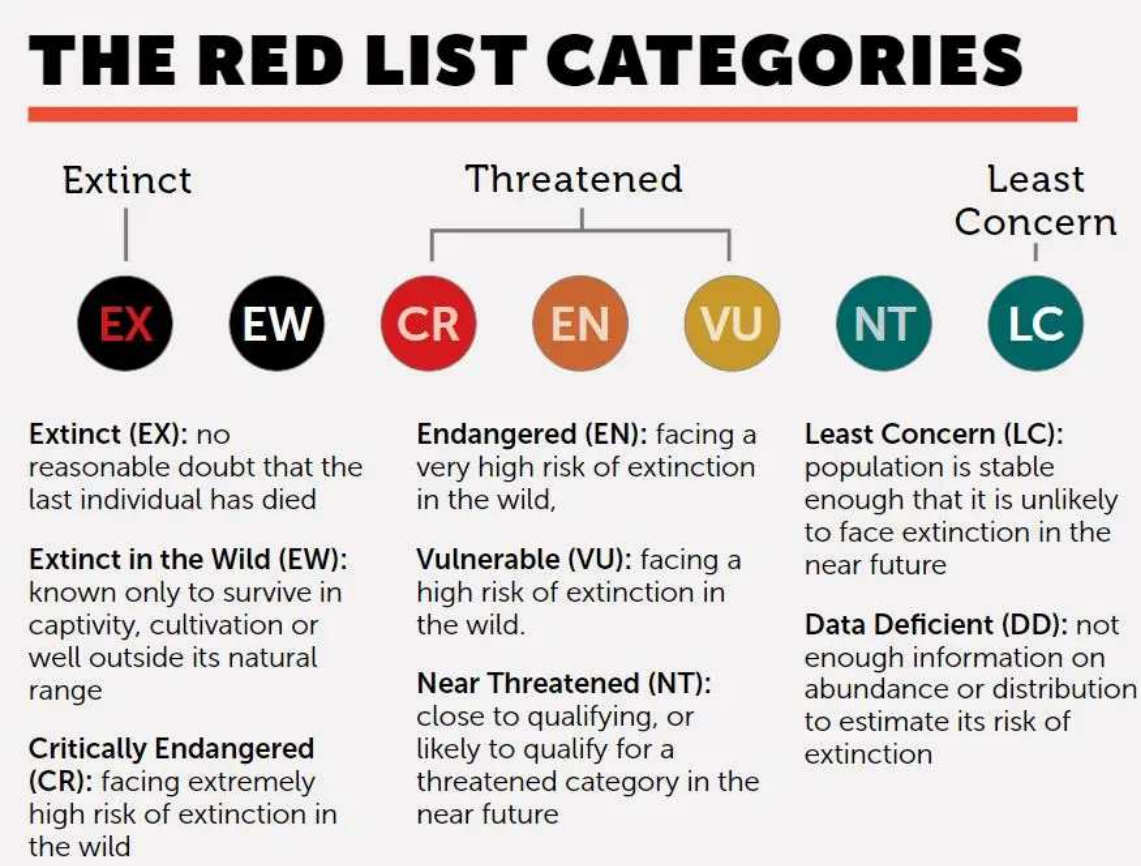
Objectives

Main objectifs:

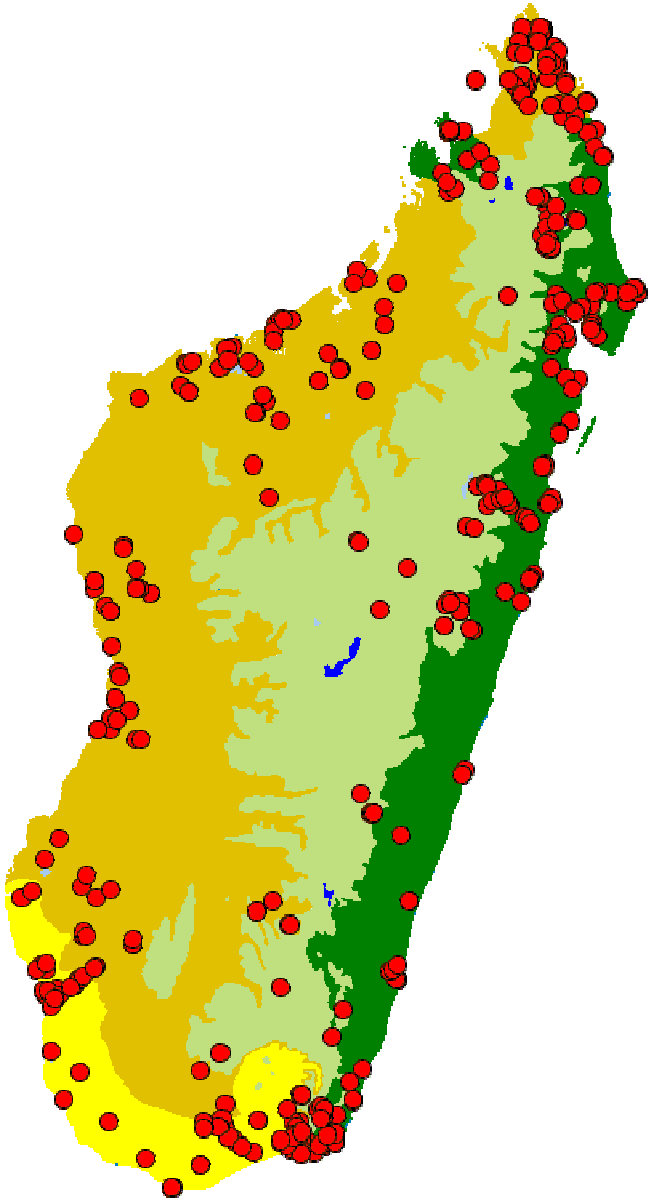
- 1° To delimit Madagascar Sapotaceae species using phylogenomics.

- 2° To conduct conservation assessments using the IUCN red list categories.

- 3 ° To reconstruct the phylogeography and study the main causes of speciation.



Materials and Methods



Field and herbarium sampling

Materials and Methods

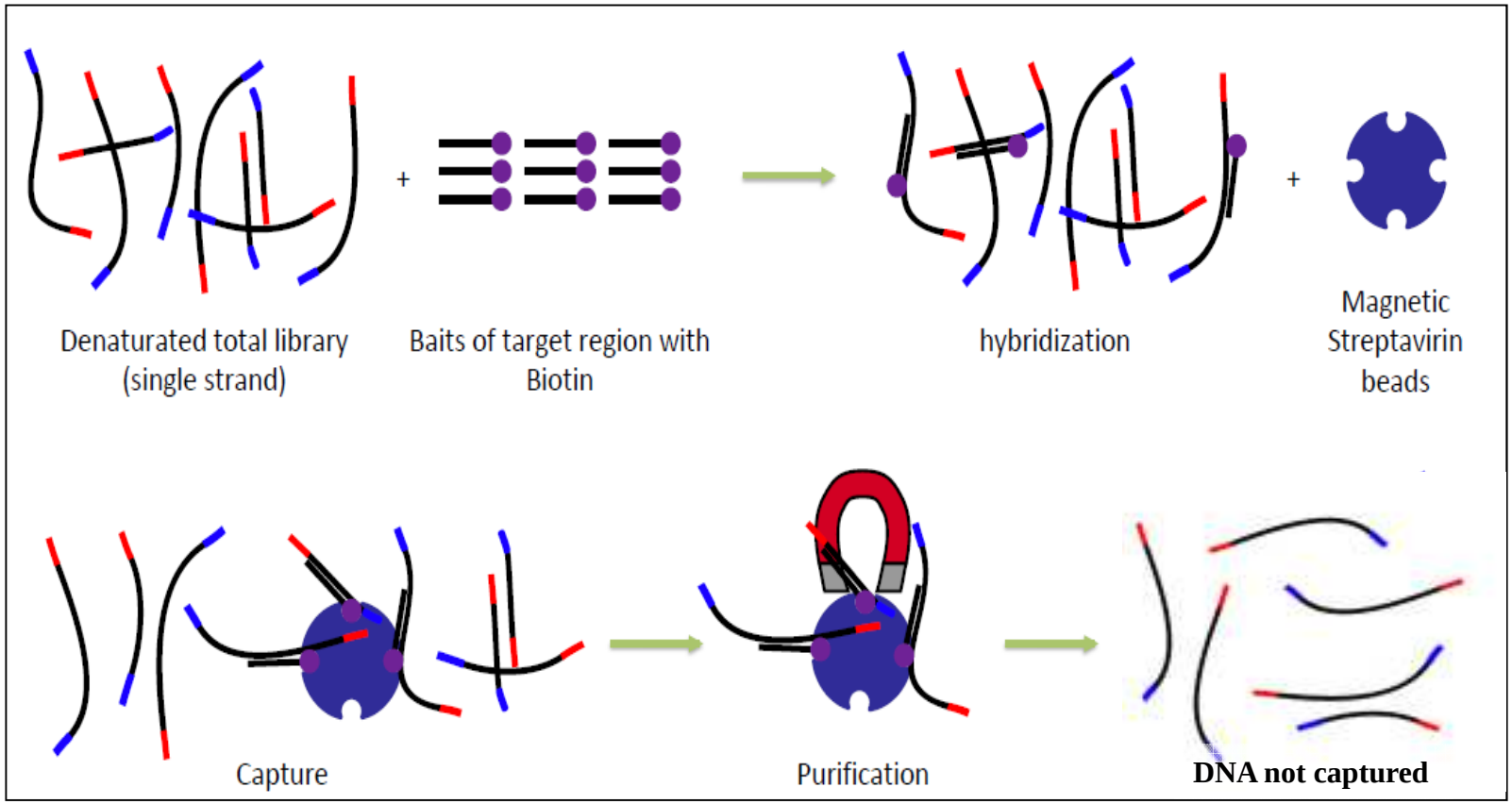
Grouping by morphospecies:

- **Selection of at least 3 specimens per morphospecies (up to 20 in species complexes) for a phylogenomic study.**

- **In total, close to 1000 specimens were selected across all genera.**

Materials and Methods

Gene capture



We capture 1020 loci

Results

Astral tree with 792 genes

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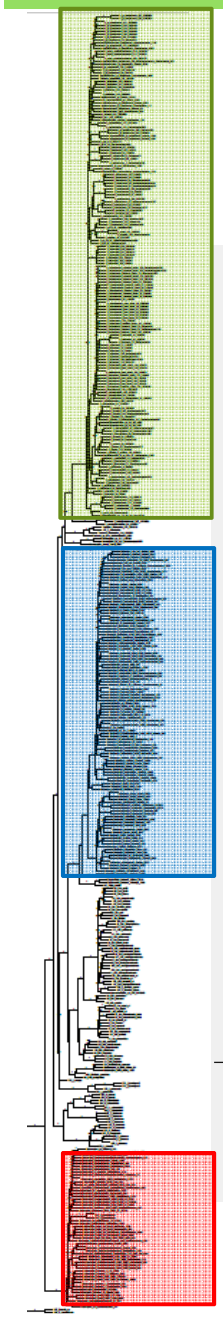
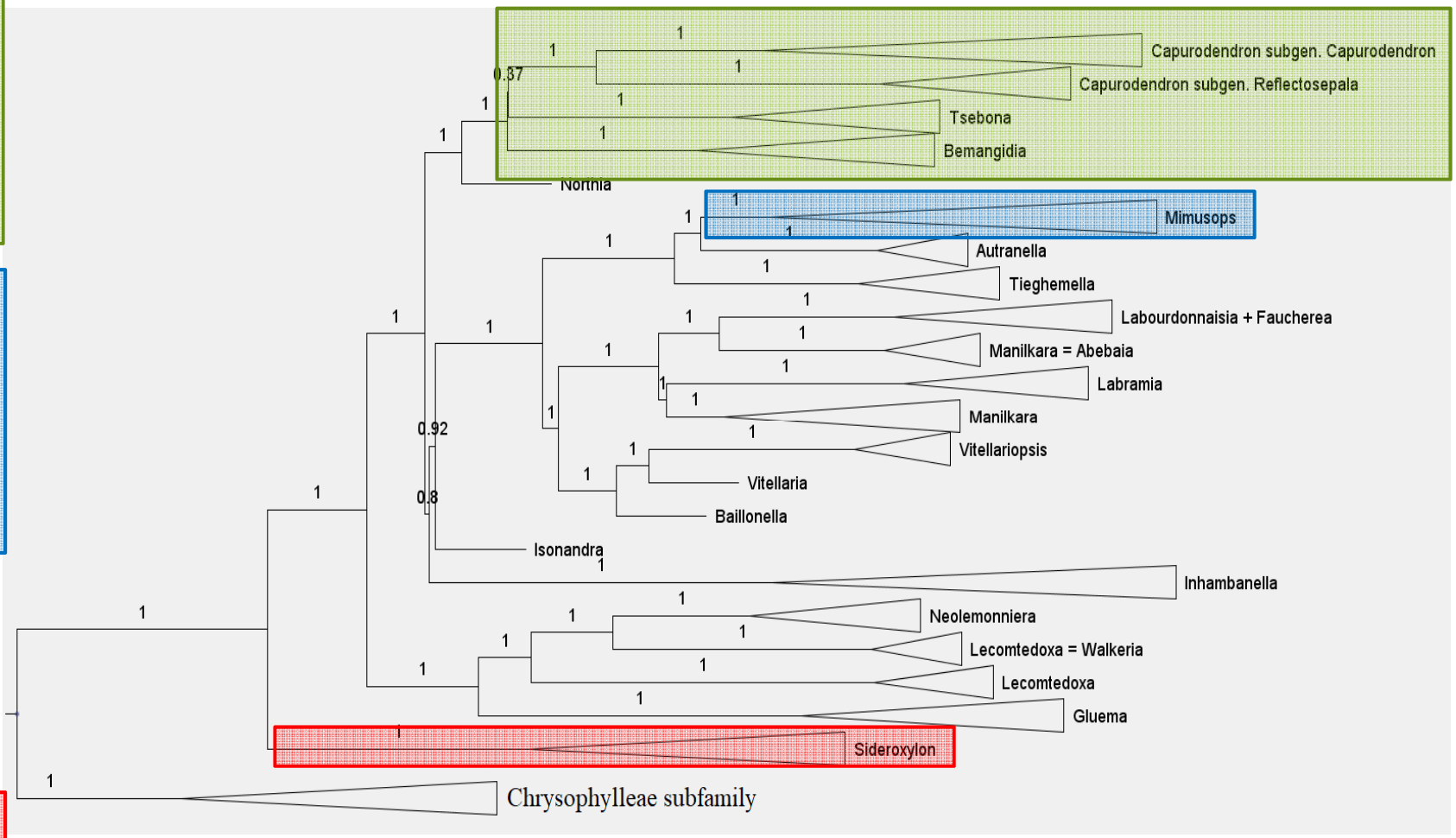
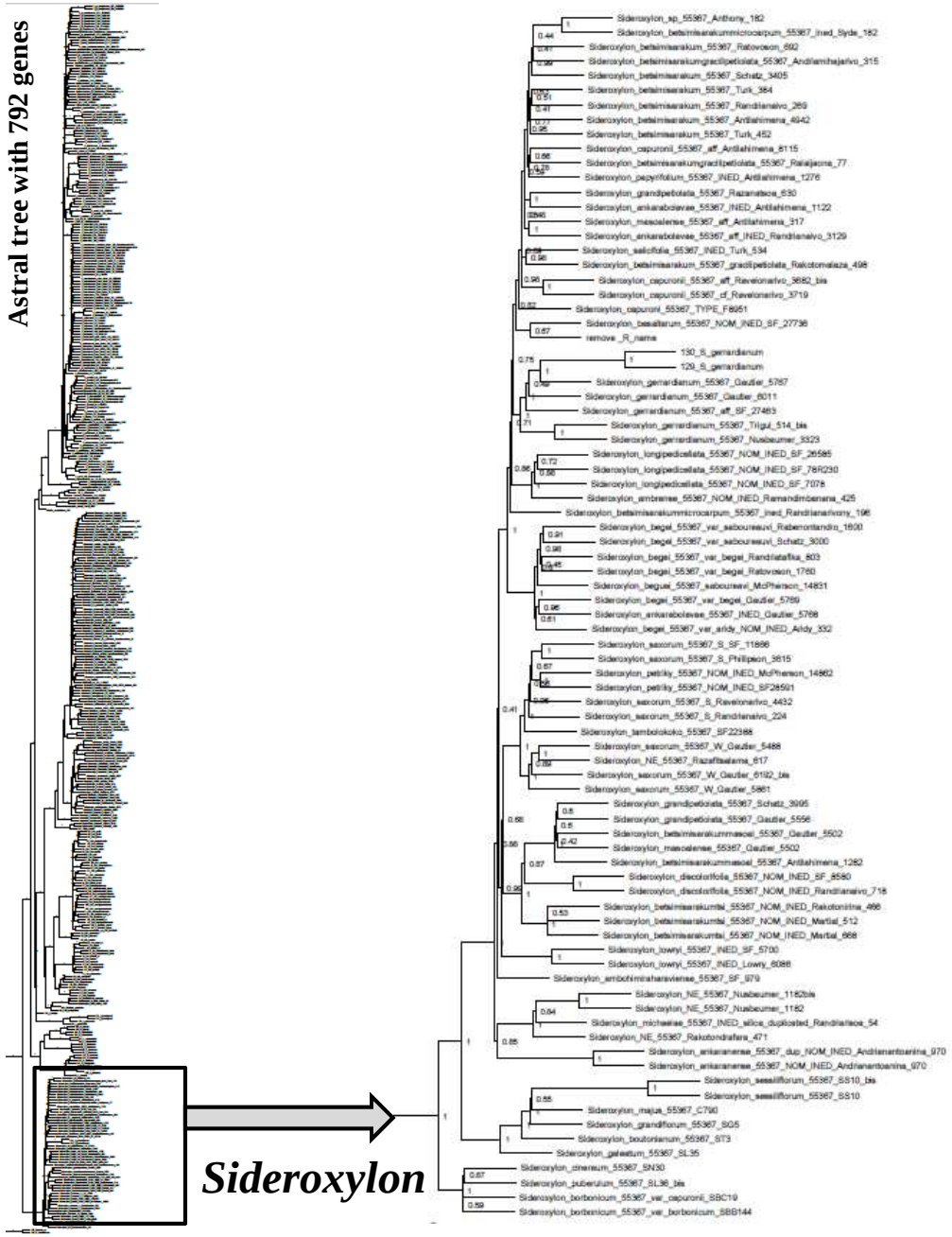


Sapotoideae subfamily main lineages



Results: Species delimitation in *Sideroxylon*



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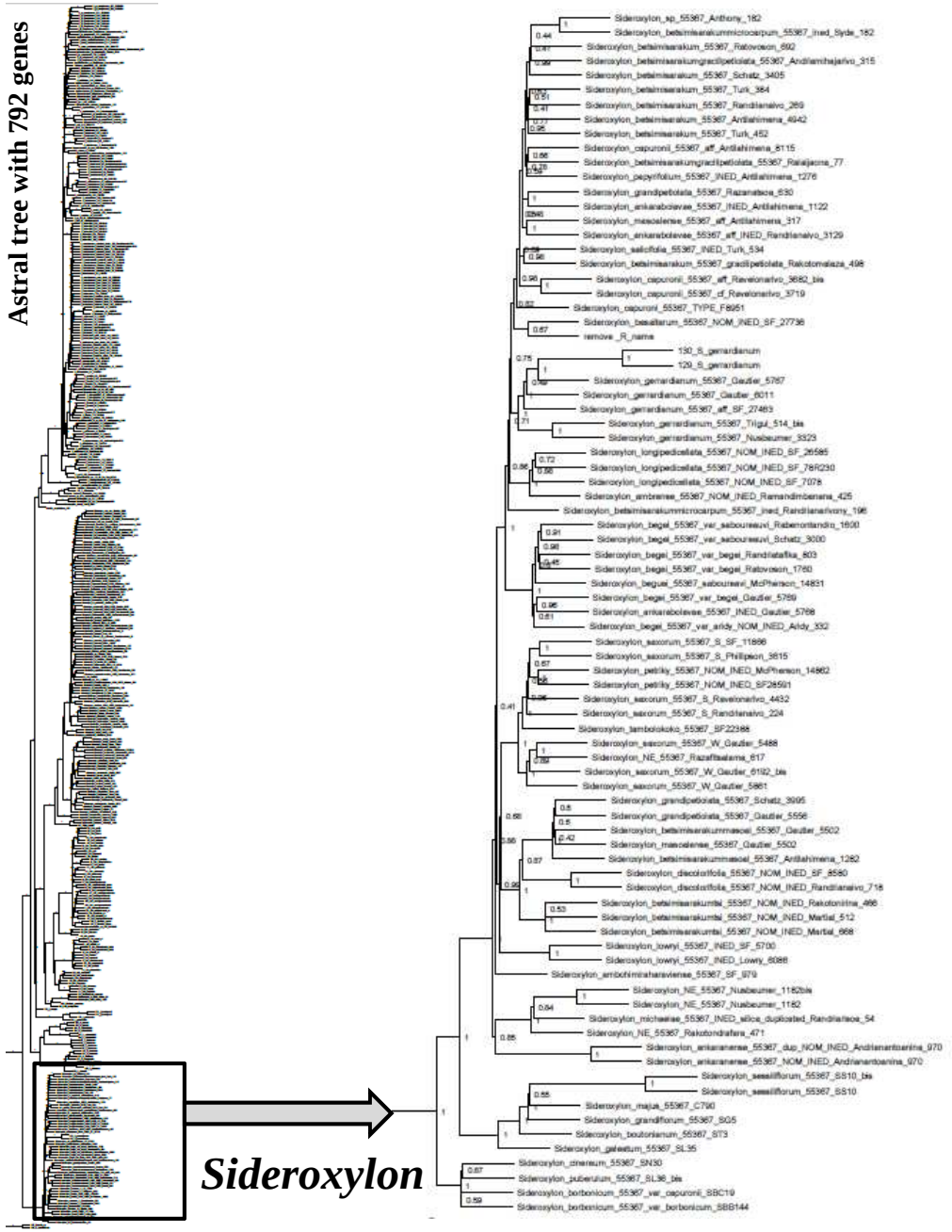

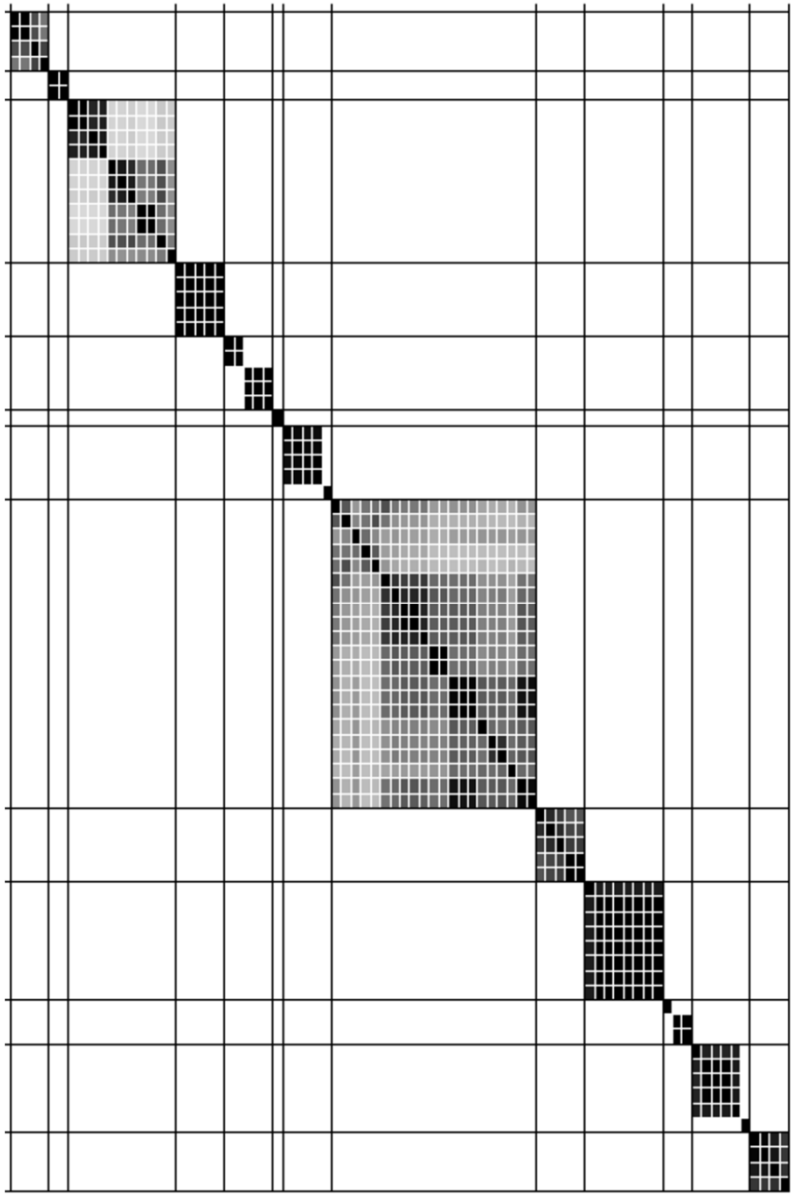

Estimation of the “phylogenetic species” candidates according to the Multispecies Coalescent method of STACEY

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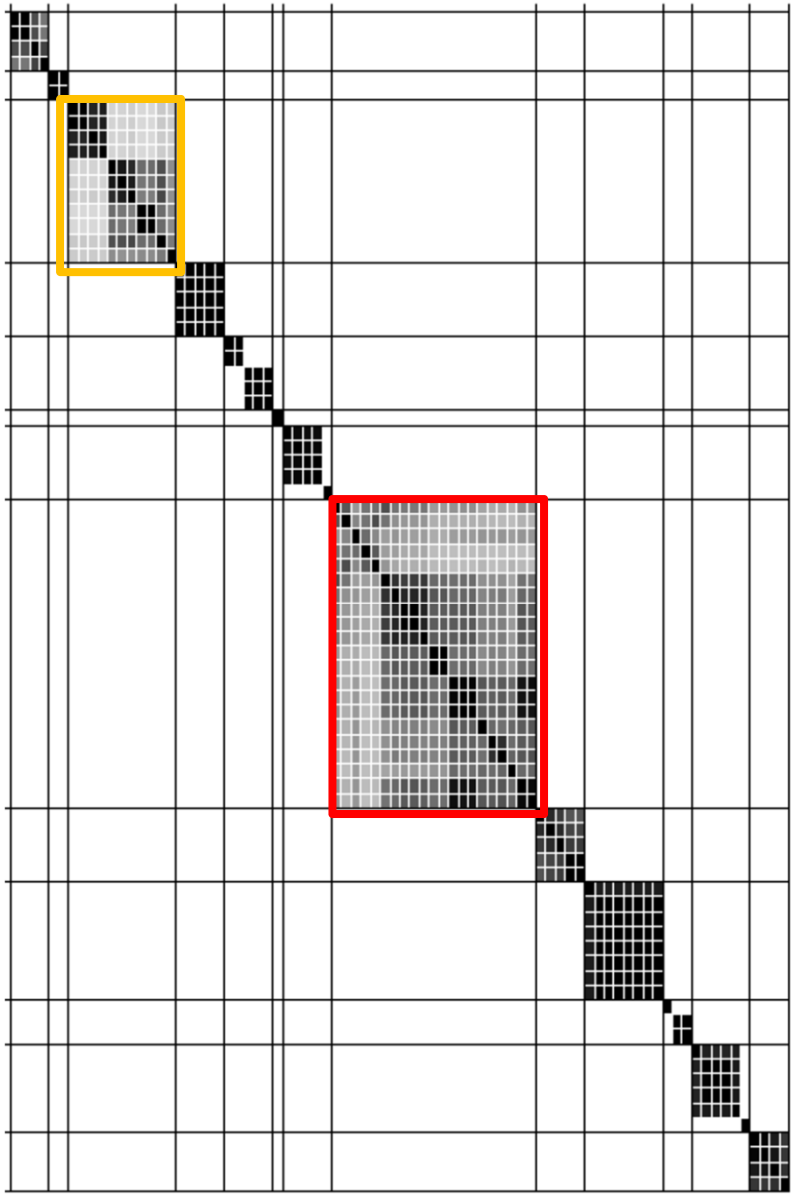

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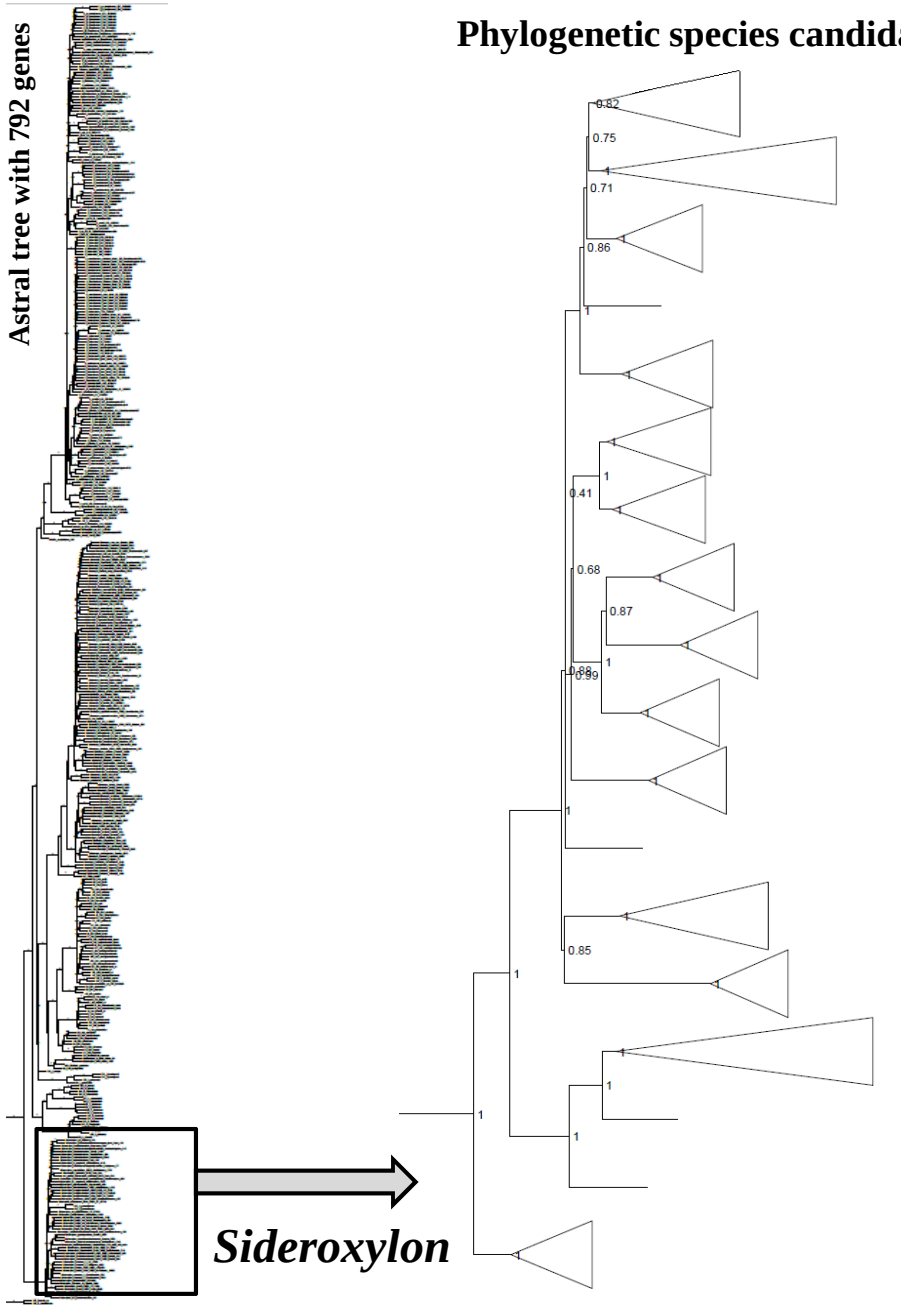
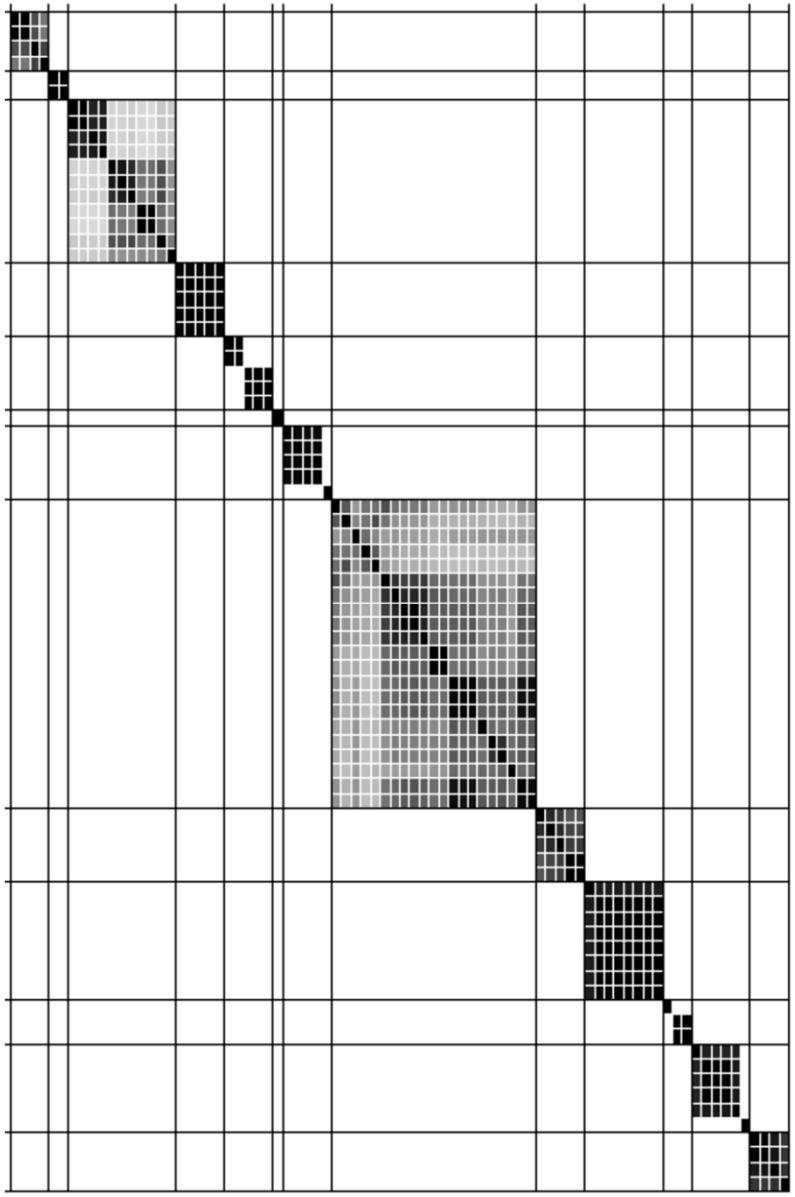


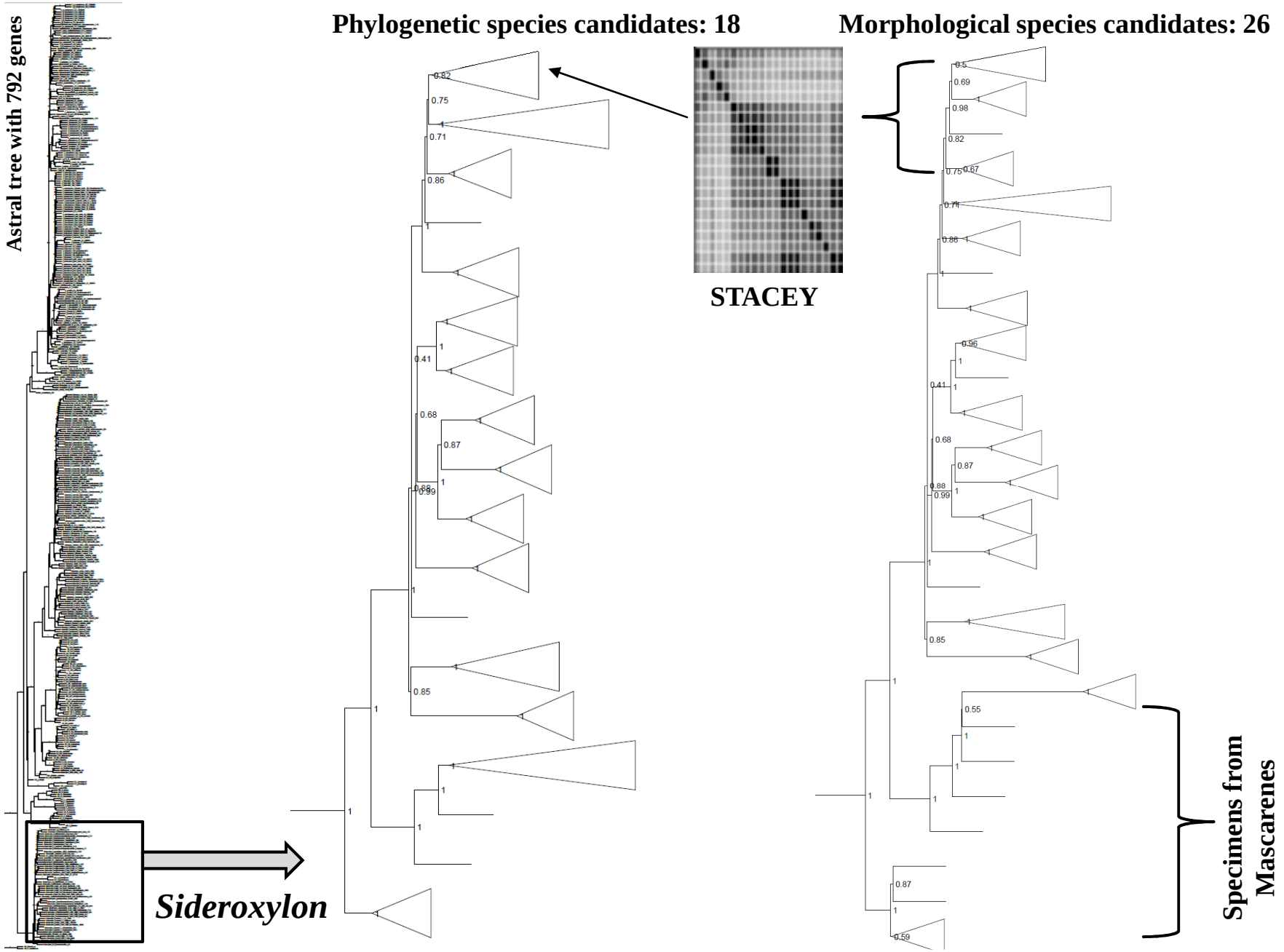


Estimation of the "phylogenetic species" candidates according to the Multispecies Coalescent method of STACEY

Results: Species delimitation in *Sideroxylon*

Comparison between morphology and phylogenetic species candidates

Results: Species delimitation in *Sideroxylon*



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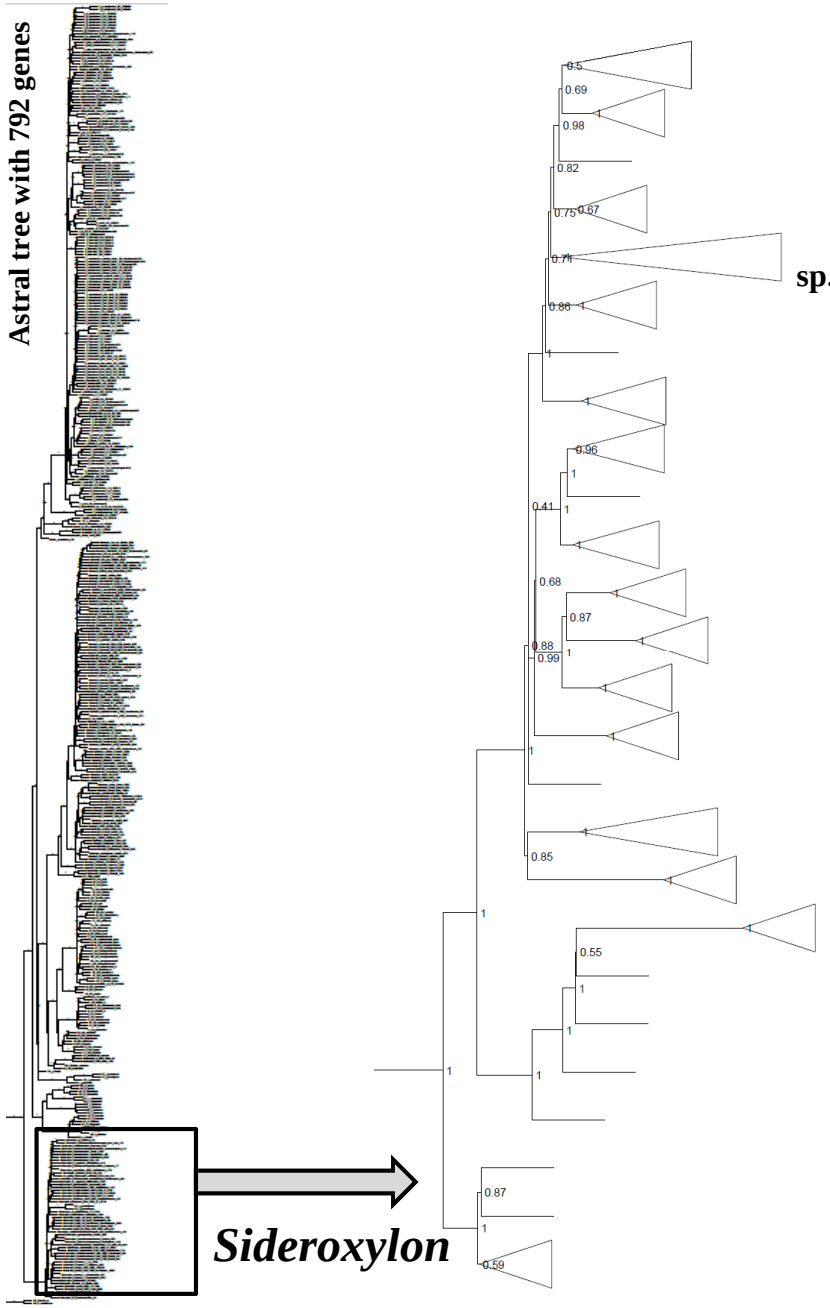
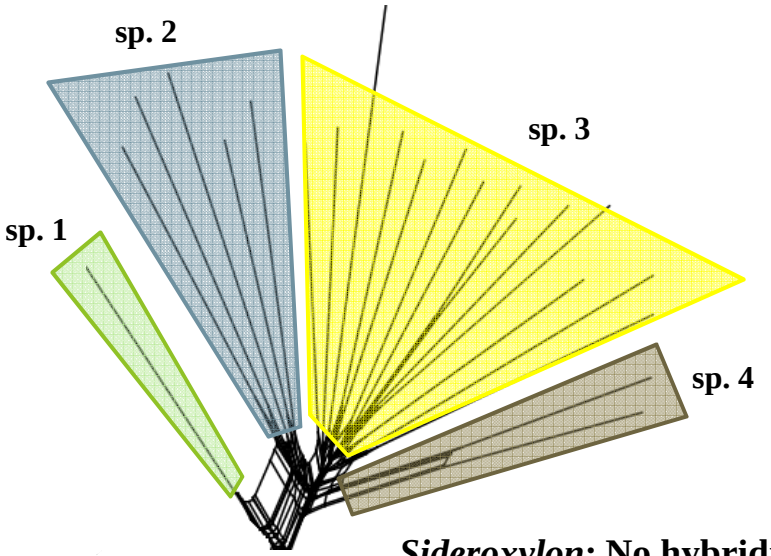
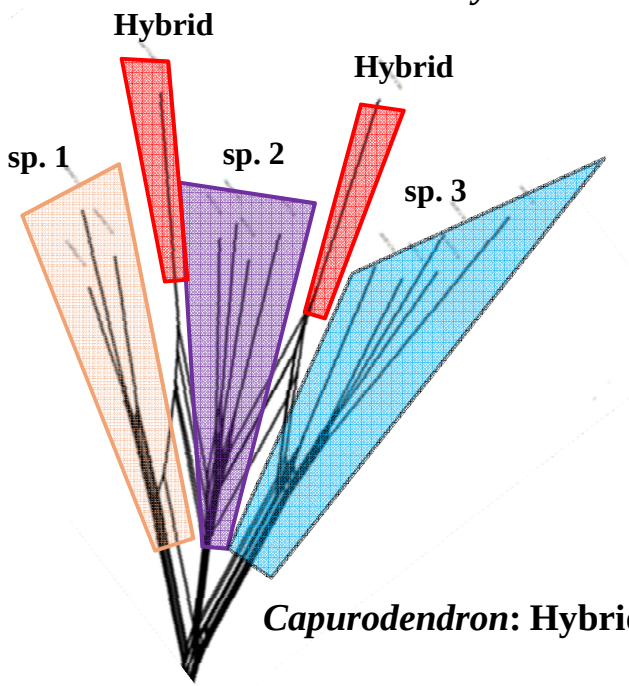


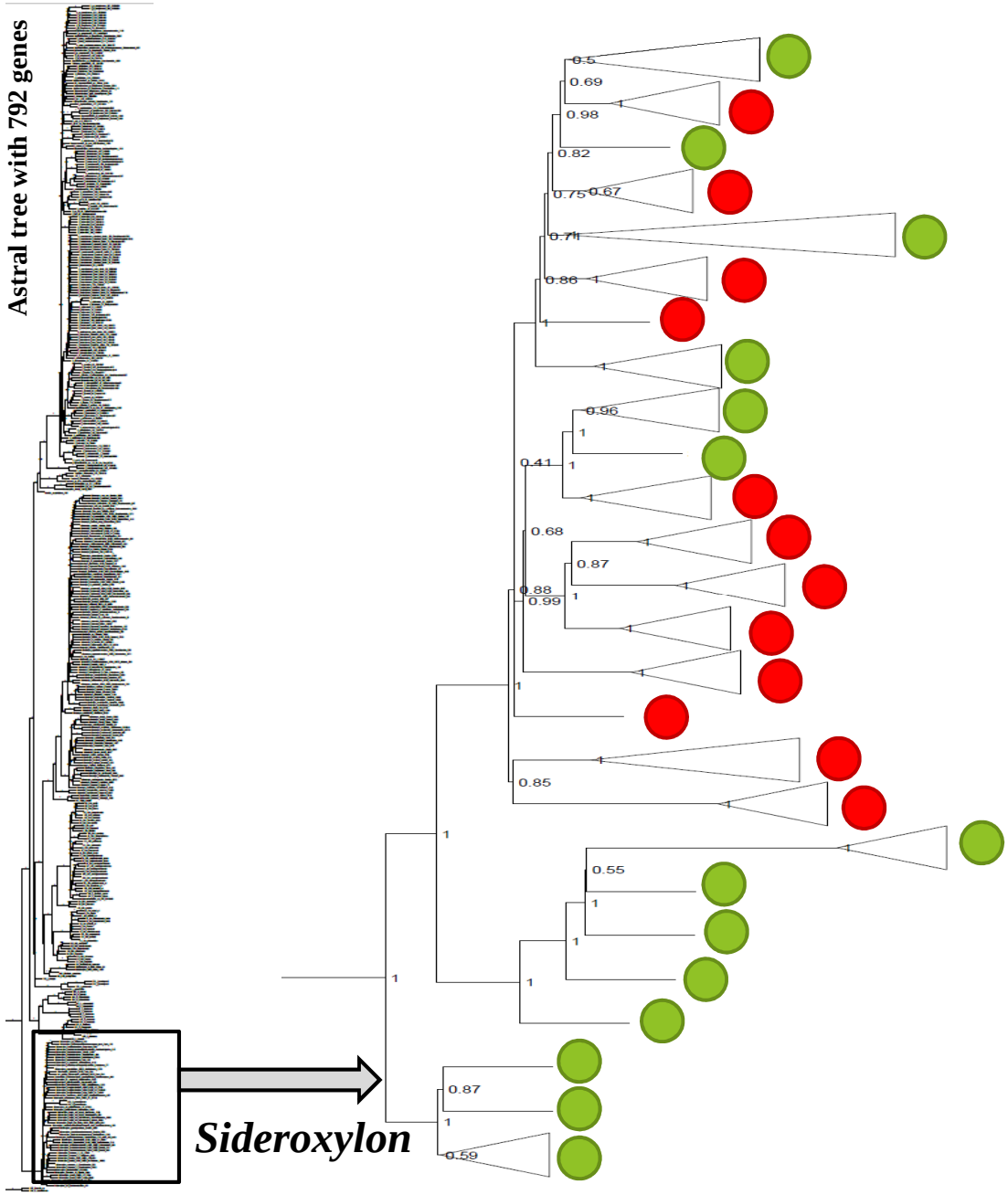


***Sideroxylon*: No hybridization signals**



***Capurodendron*: Hybridization signals**

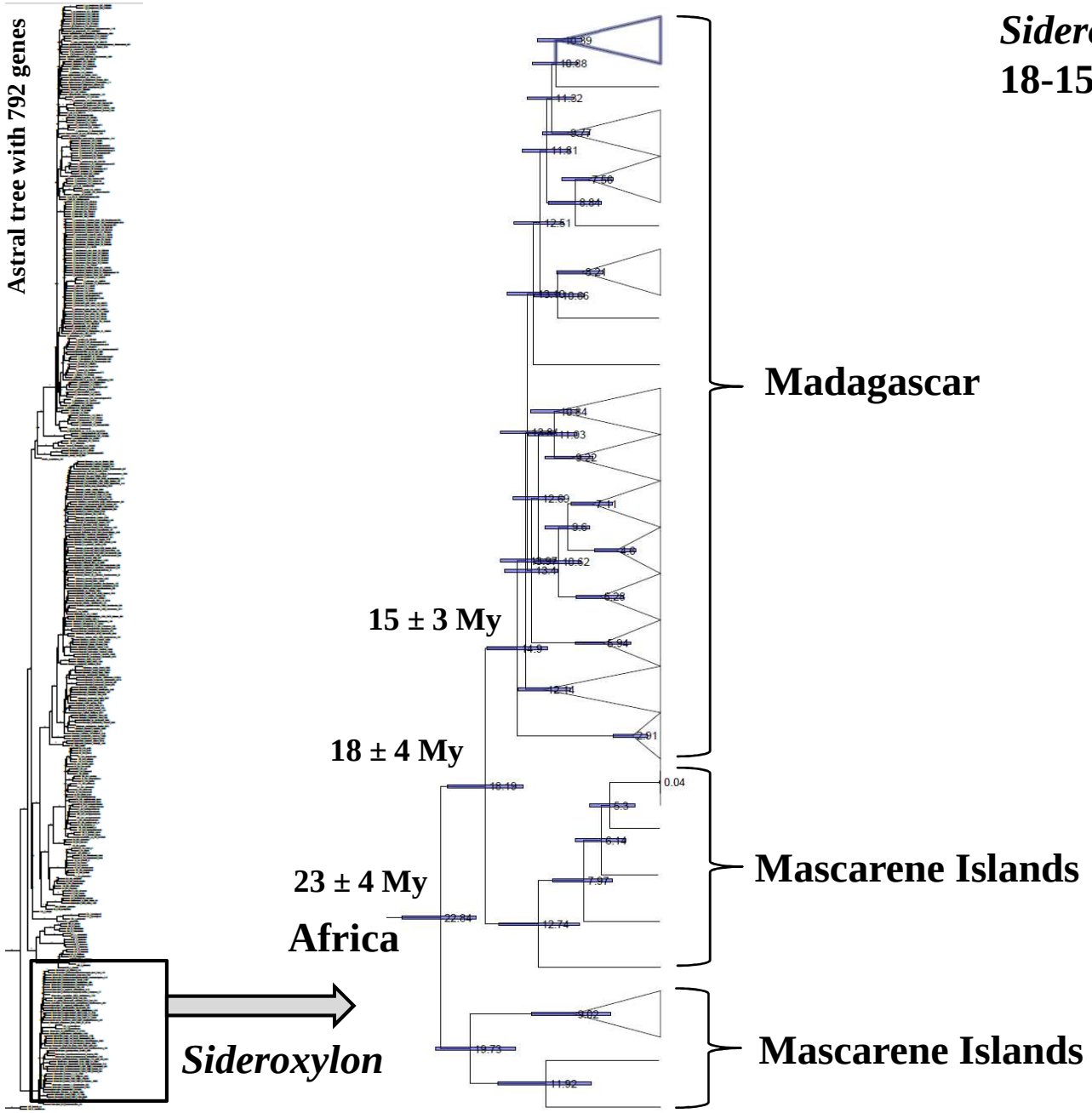
Results: Species limits in *Sideroxylon*



Described species (15)

Undescribed species (12)

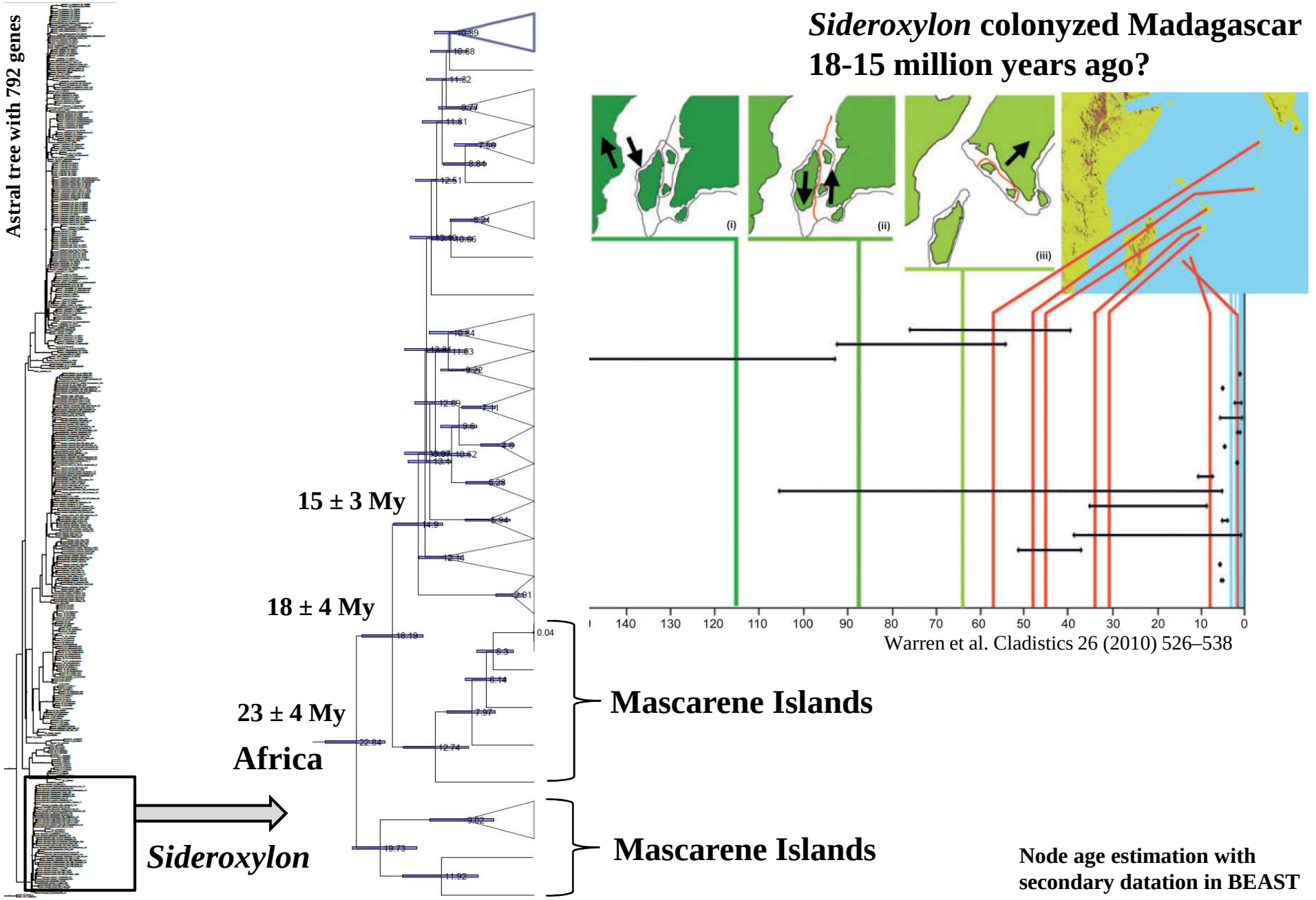
Results: Species limits in *Sideroxylon*



***Sideroxylon* colonized Madagascar 18-15 million years ago?**

Node age estimation with secondary datation in BEAST

Results: Species limits in *Sideroxylon*



***Sideroxylon* colonyzed Madagascar 18-15 million years ago?**

Warren et al. Cladistics 26 (2010) 526–538

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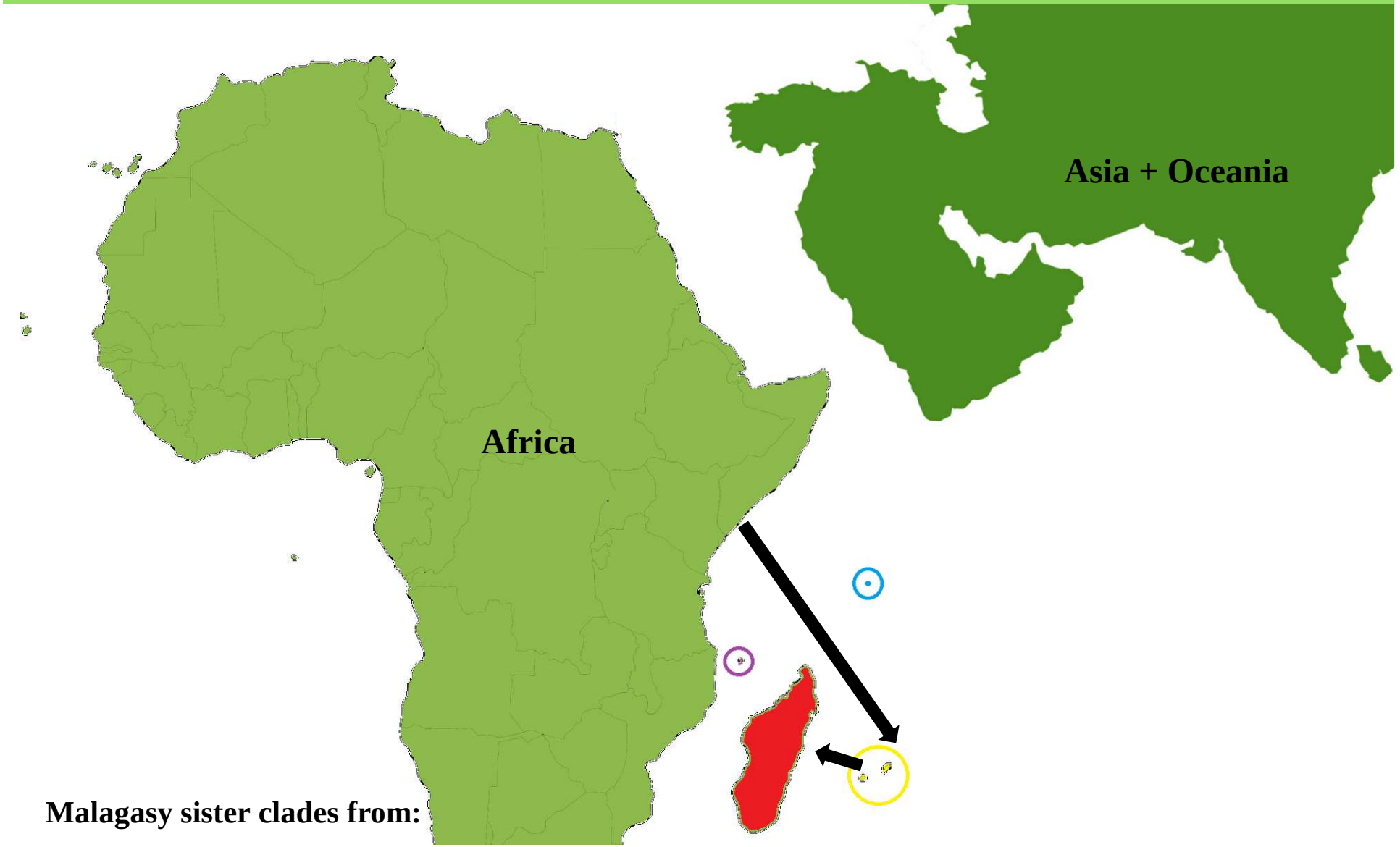
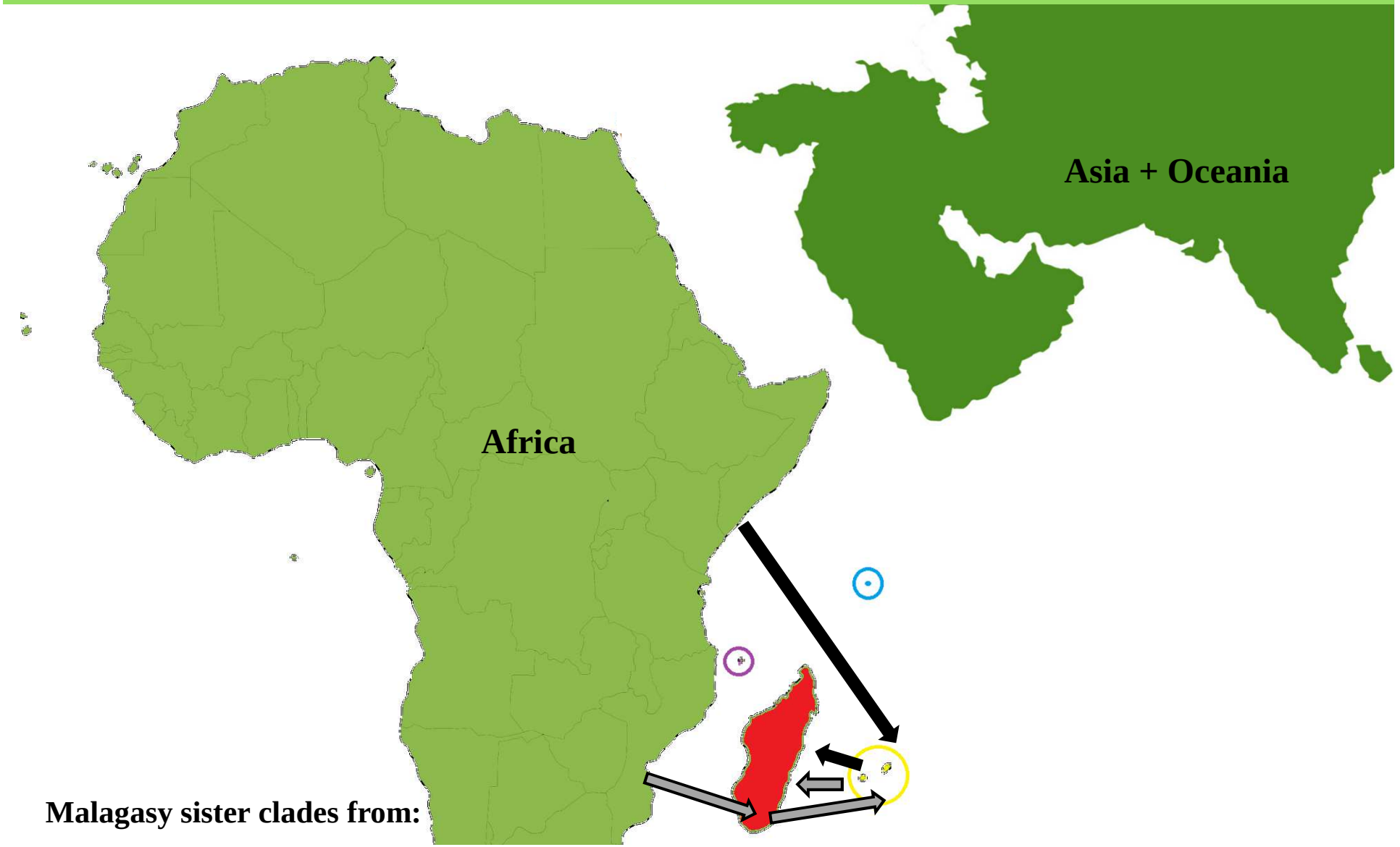
Results: Origin of Malagasy Sapotaceae



Malagasy sister clades from:

***Sideroxylon*: Mascarenes**

Results: Origin of Malagasy Sapotaceae



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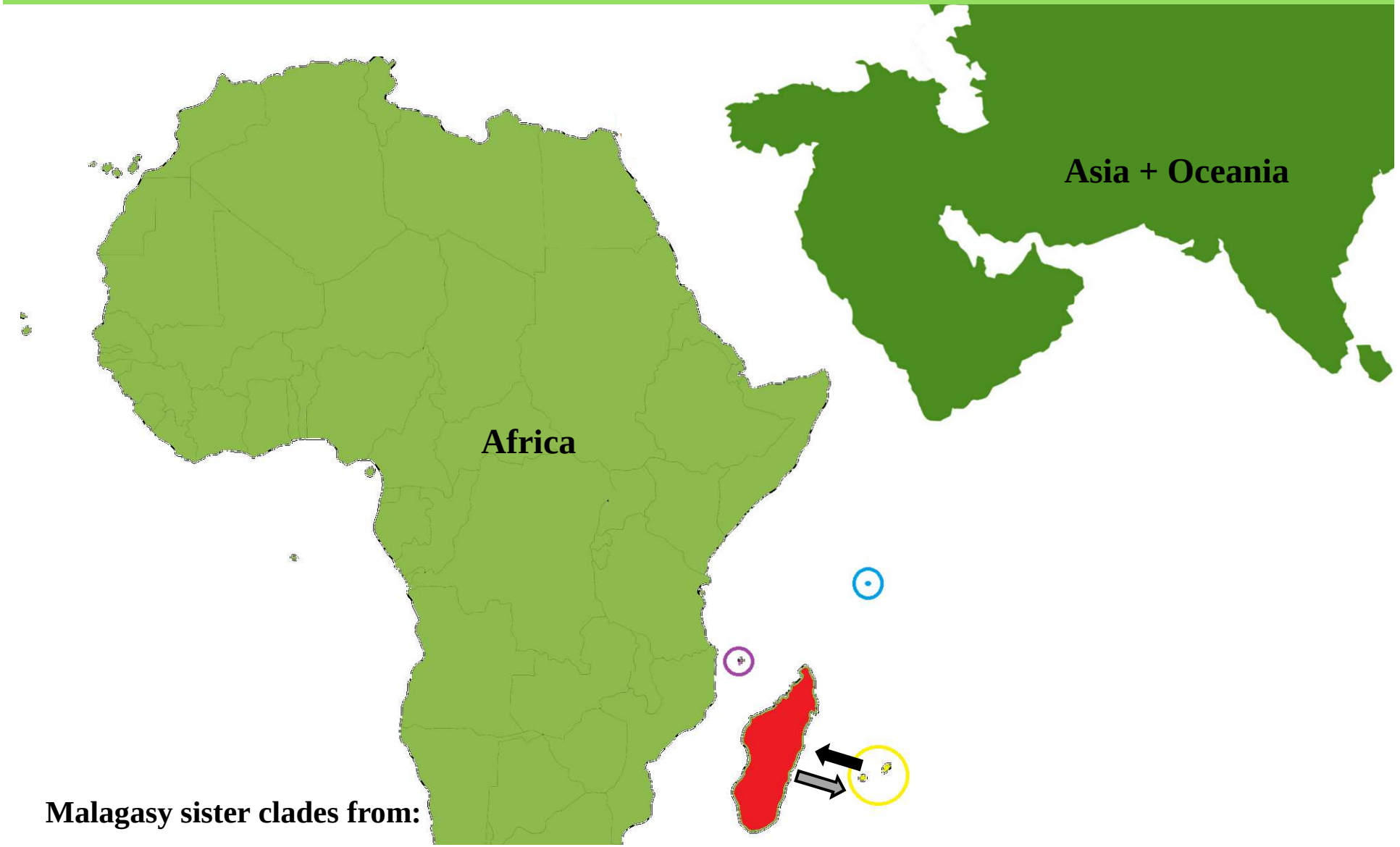
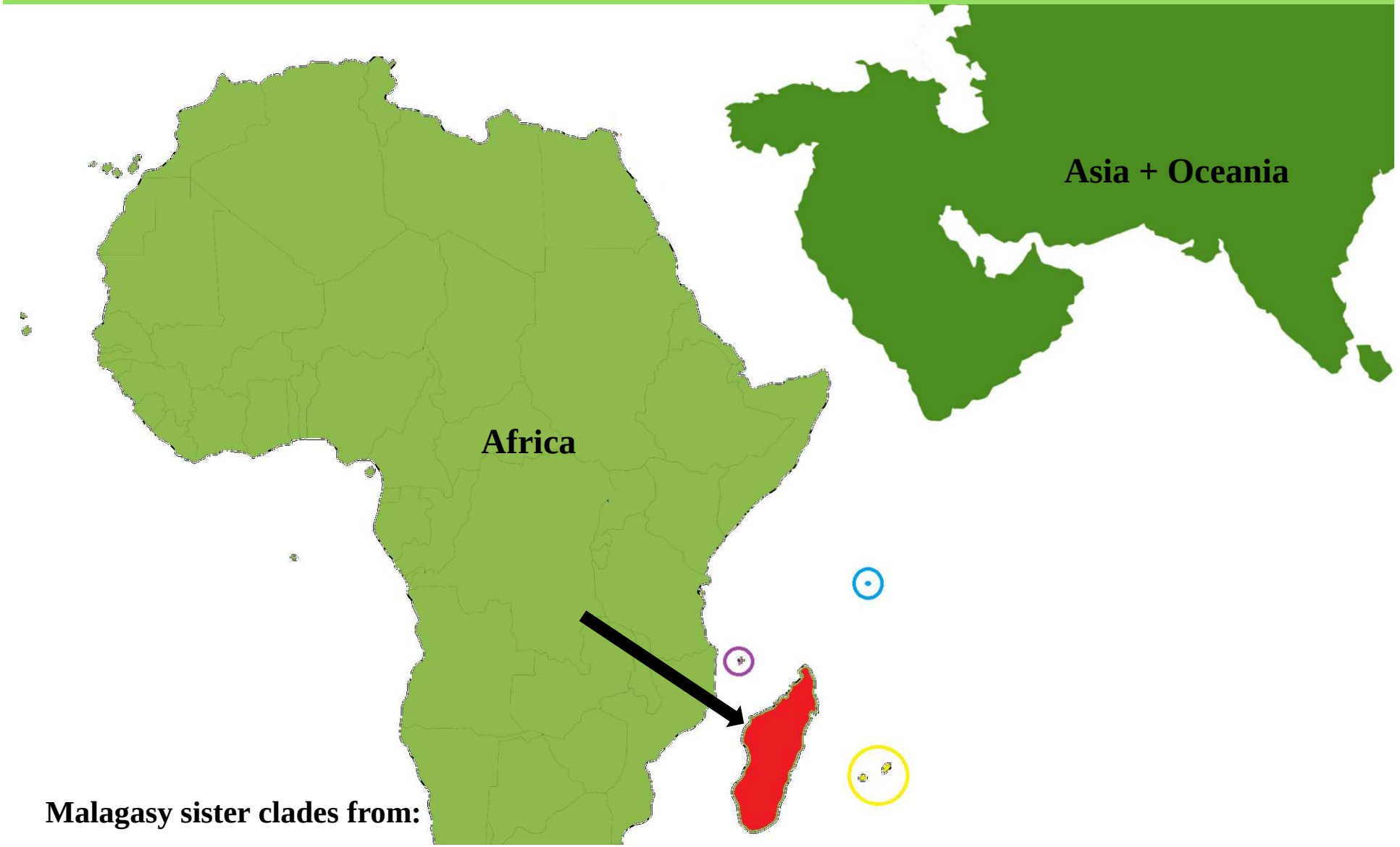


Malagasy sister clades from:

***Sideroxylon*: Mascarenes**
***Labourdonnaisia*: Mascarenes**

Results: Origin of Malagasy Sapotaceae



Malagasy sister clades from:

***Sideroxylon*: Mascarenes**
***Labourdonnaisia*: Mascarenes**
***Manilkara*: Africa**
***Gambeya*: Africa**

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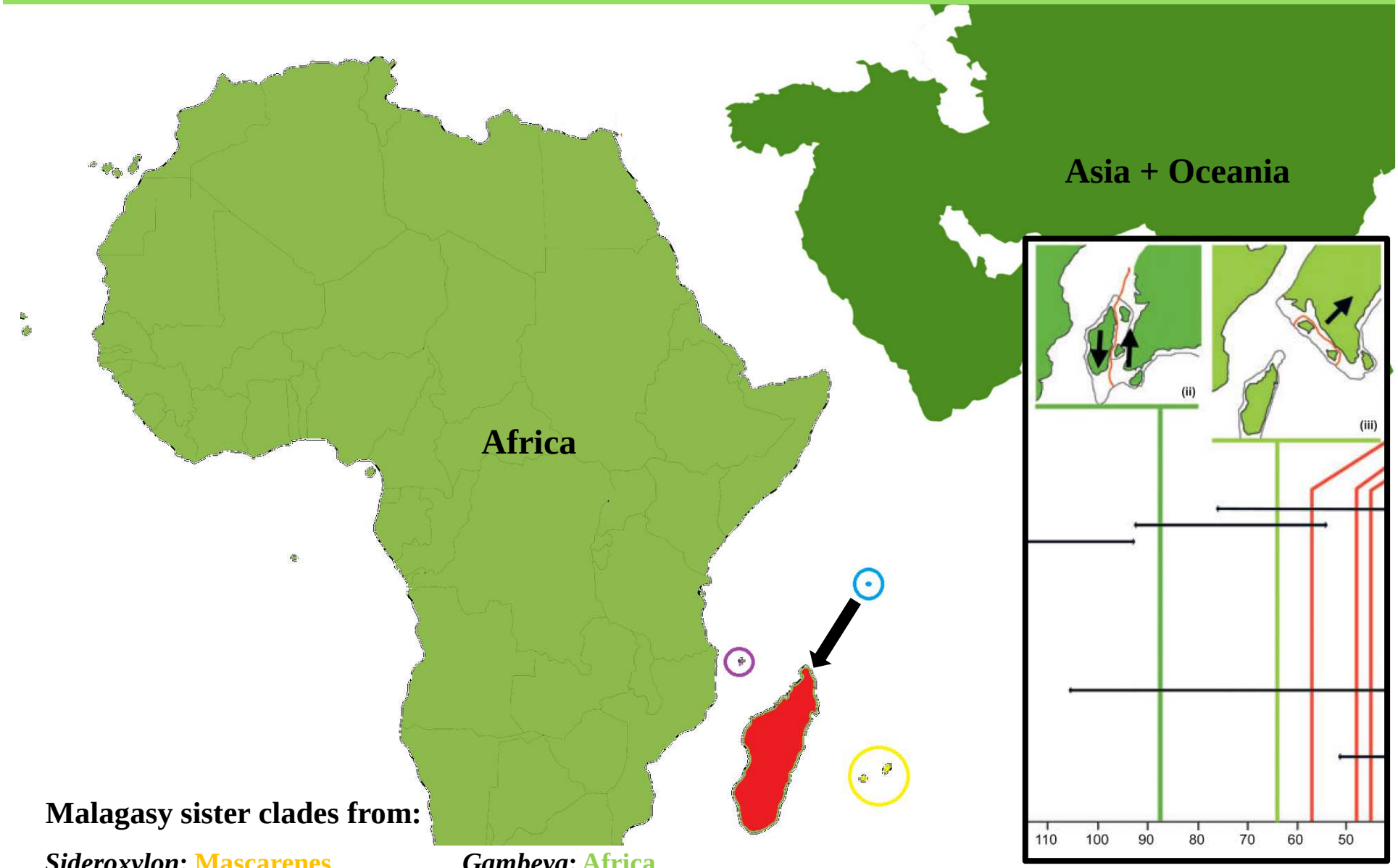

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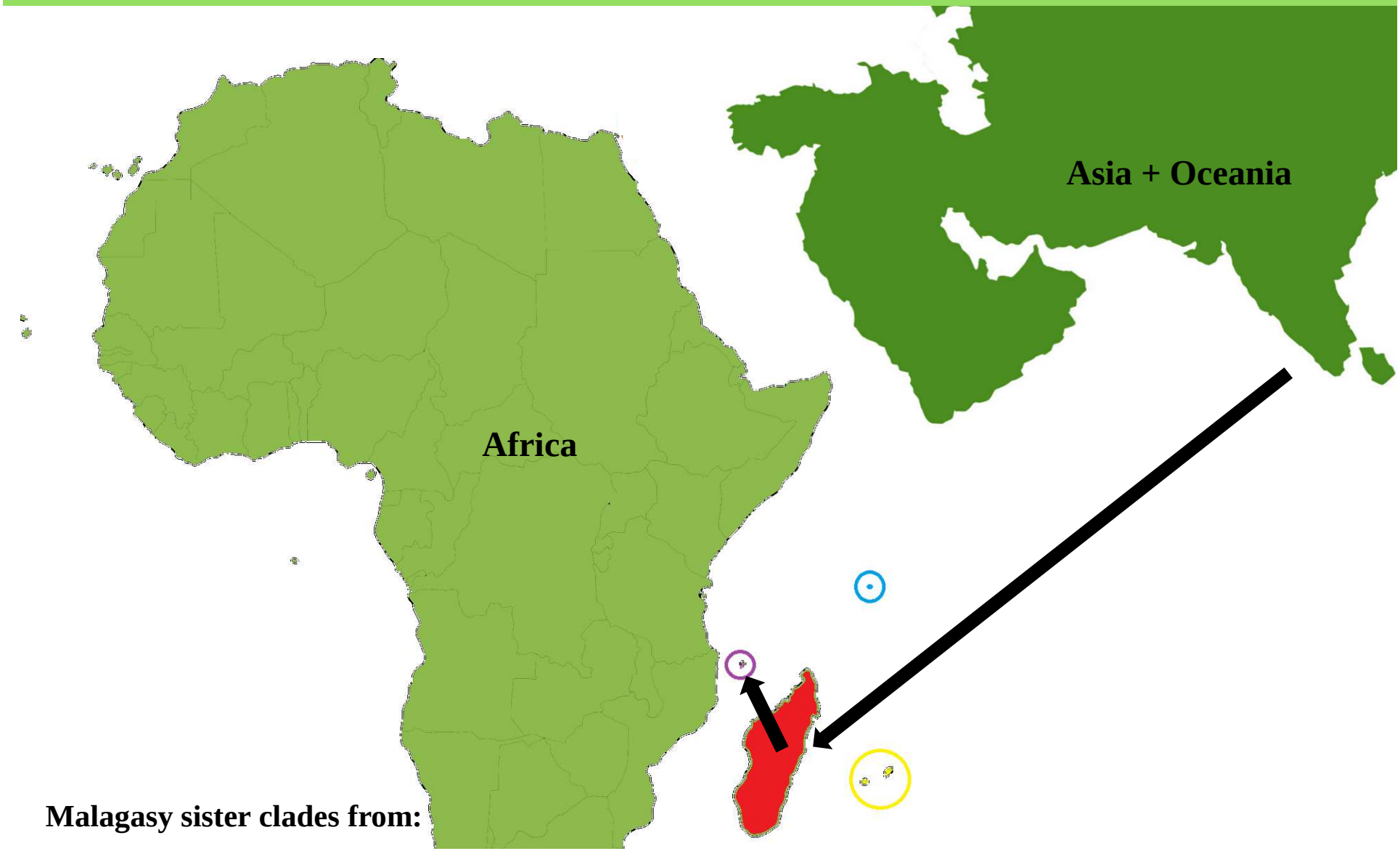
***Bemangidia, Capurodendron Tsebona*: Seychelles**

Warren et al. Cladistics 26 (2010) 526–538

LG17

Results: Origin of Malagasy Sapotaceae



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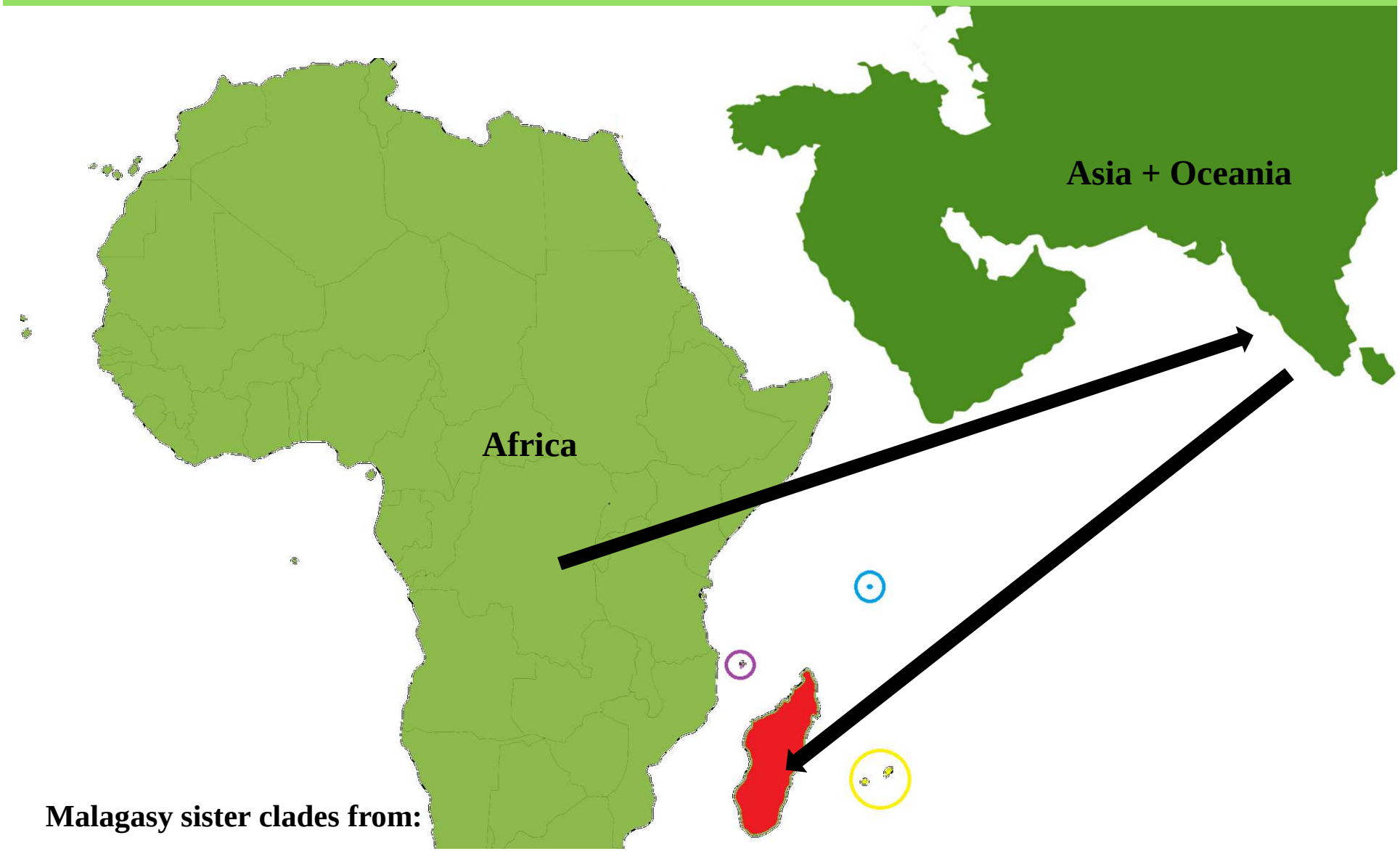
***Bemangidia, Capurodendron Tsebona*: Seychelles**
***Labramia*: Asia**

Diapositiva 28

LG17 Why Asia for Labramia? Because of the relationship with Abebaia? But I thought that Abebaia was related with Labourdonnaisia.
Laurent Gautier; 19/09/2022

Results: Origin of Malagasy Sapotaceae



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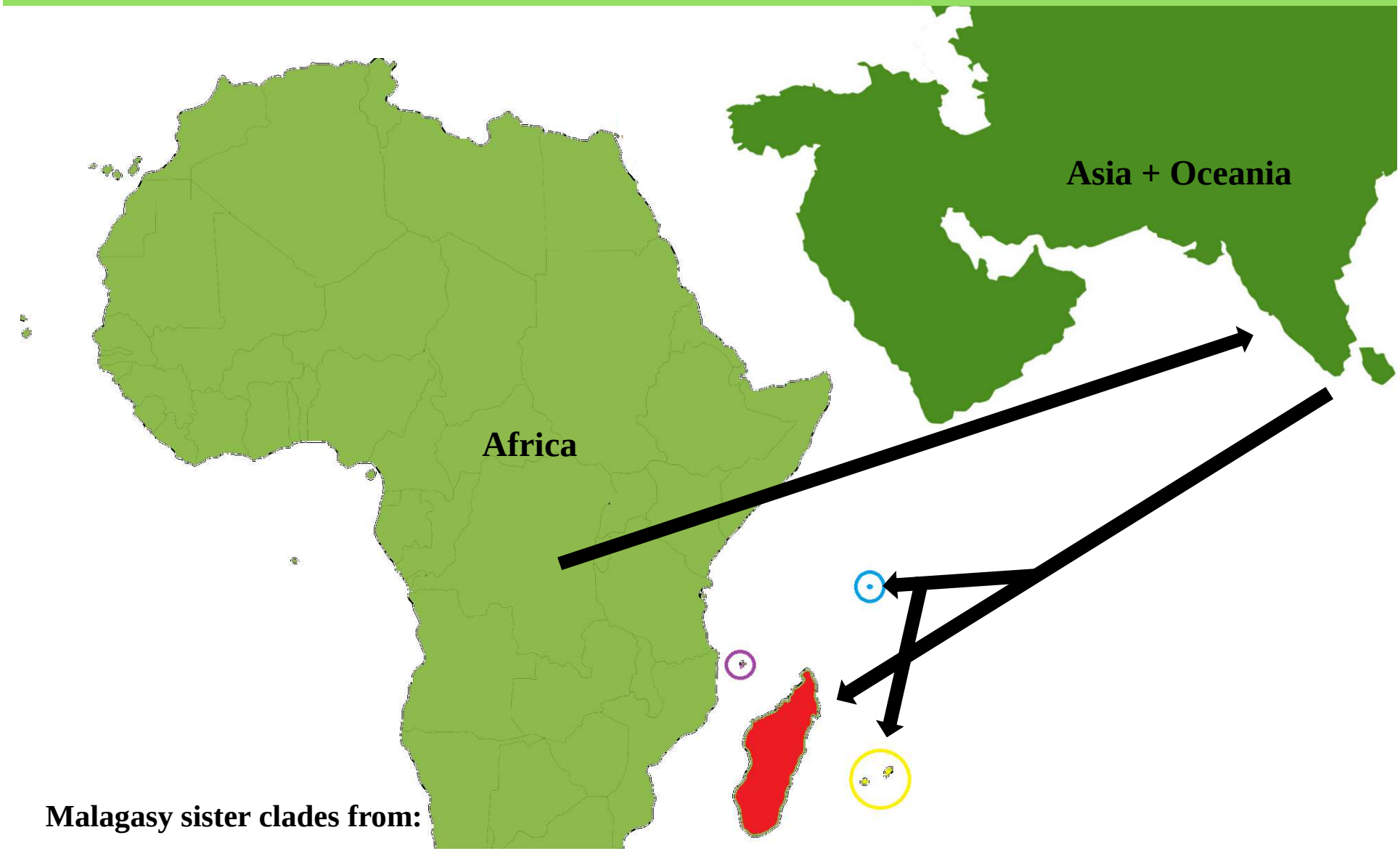
***Labramia*: Asia**

***Donella*: Asia**

Results: Origin of Malagasy Sapotaceae



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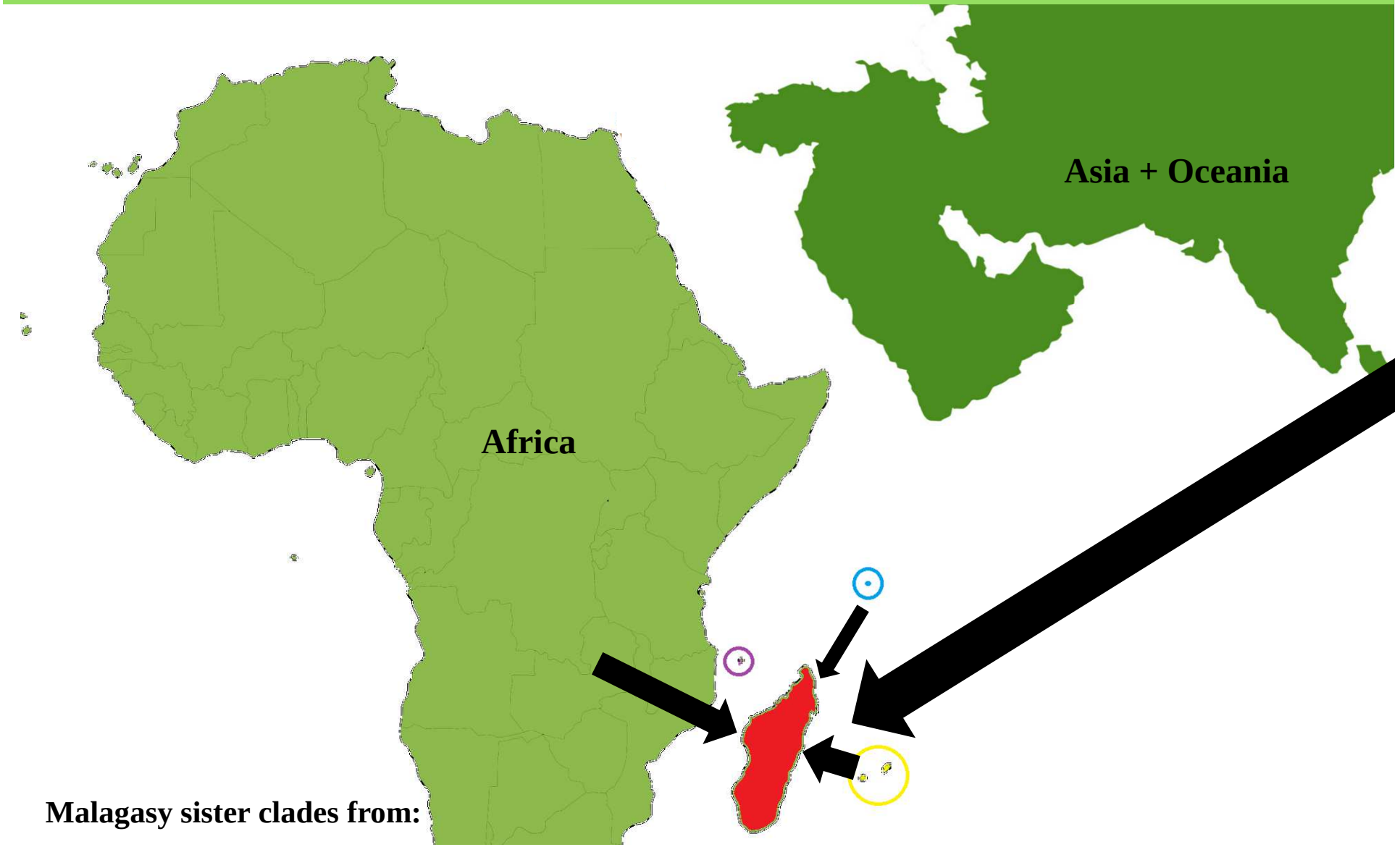
***Mimusops*: Asia**

Results: Origin of Malagasy Sapotaceae



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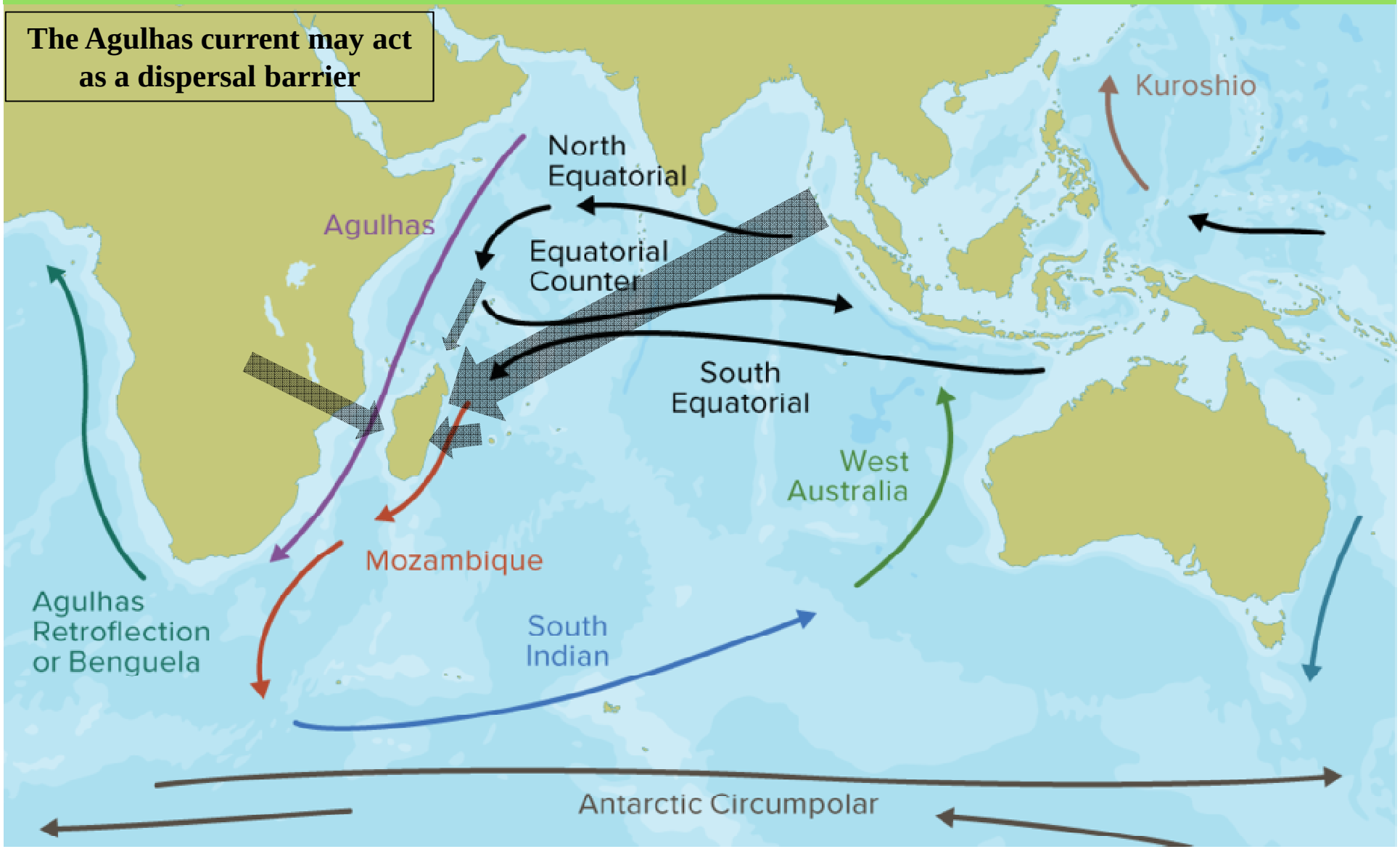
Results: Origin of Malagasy Sapotaceae

The Agulhas current may act as a dispersal barrier



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***Donella*: Asia**
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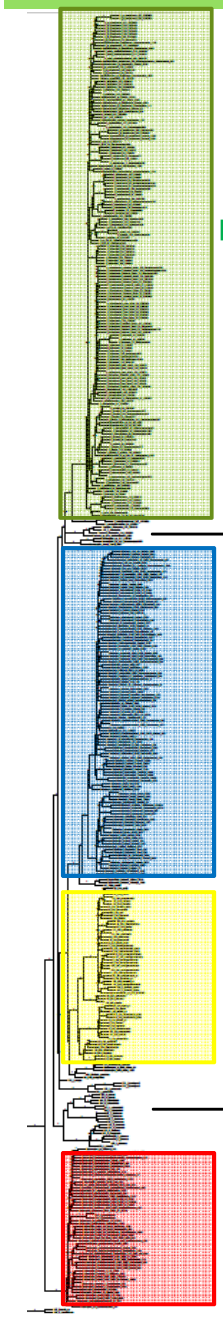
Preliminary conclusions



Capurodendron
At least 31 new species on Madagascar

+ 2 new species

Mimusops
At least 14 new species on Madagascar

Labourdonnaisia, Labramia, Manilkara
Still unknown

+ 2 new species

Sideroxylon
At least 12 new species on Madagascar

Estimations:

~160 species in total.

~70-80 new species.

1 possible new genus

~70% Endangered or Critically Endangered.

~6 may be extinct.

Aknowledgements LG2

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Camille Christe

Laurent Gautier

Tina Kiedaisch

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Conservatoire et Jardin botaniques Genève

FNSNF Swiss National Science Foundation

Université de Genève

Université de Genève Faculté des sciences

Franklinia Fondation

Fondation Ernst et Lucie Schmidheiny

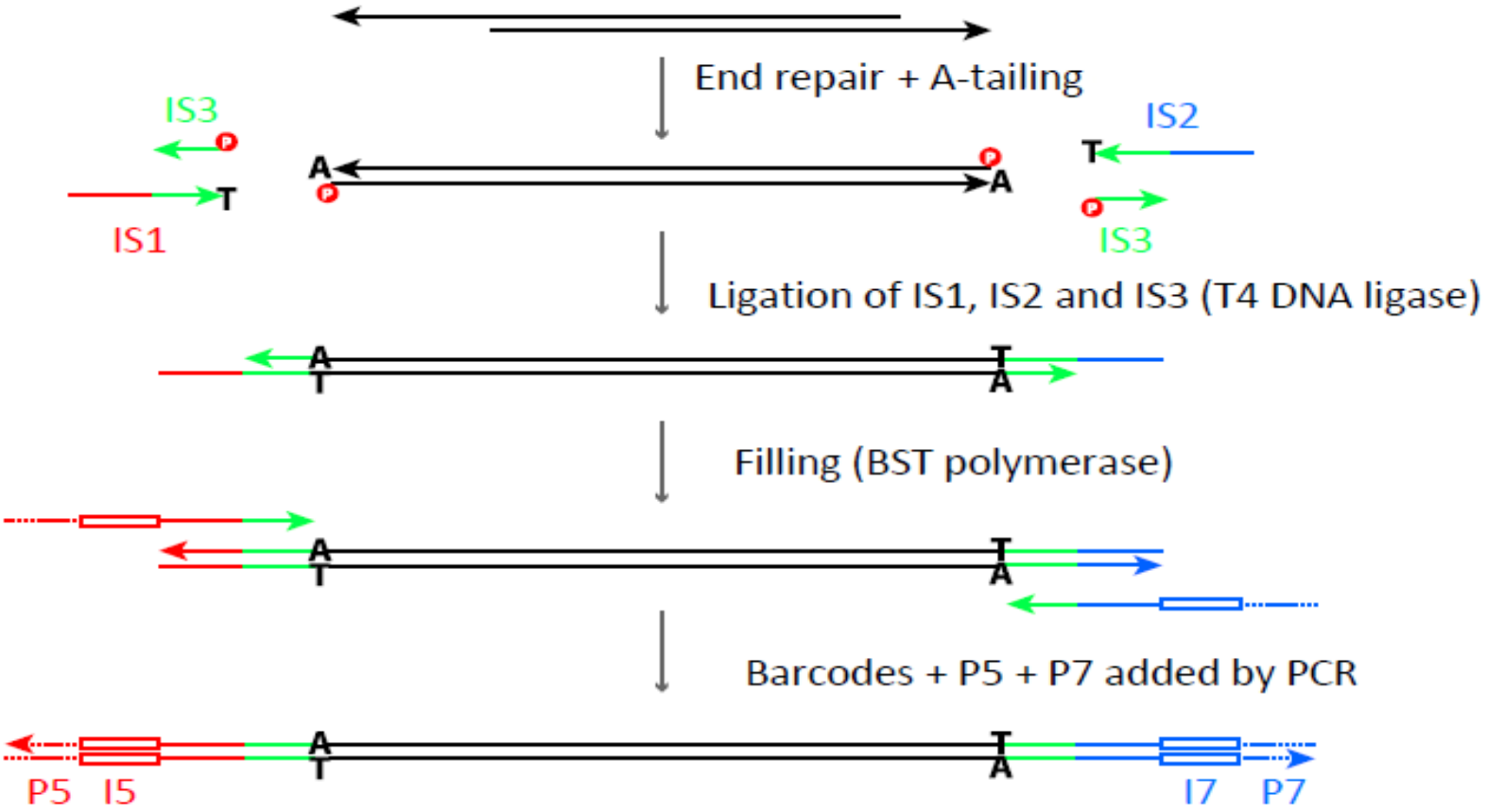
Diapositiva 34

LG2 You should really stress the support of UNIGE: Roman Ulm for continuous support with salaries / COVID issues and Martine Mir for administration

Laurent Gautier; 19/09/2022

Materials and Methods

Library construction



Introduction

Some Sapotaceae species from Madagascar:

Faucherea littoralis sp. nov.

Labramia costata

Labramia costata

Mimusops coriacea

Labramia bojeri

Capurodendron androyense

Mimusops coriacea

Sideroxylon sp. nov.