

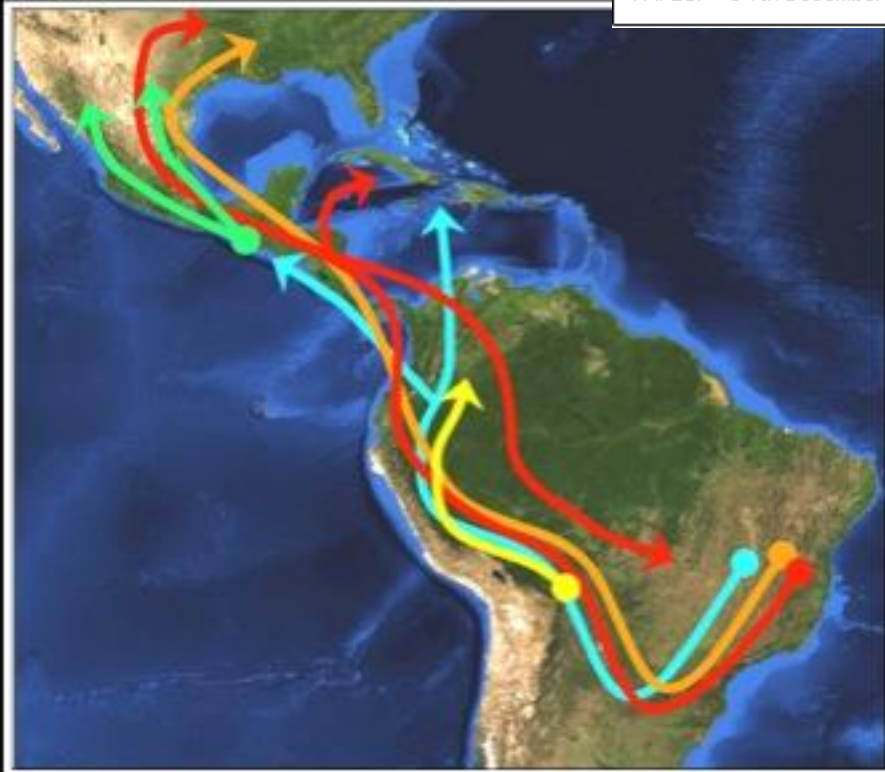
An Overview of the Biogeography and Relationships of the New World Vernoniaeae



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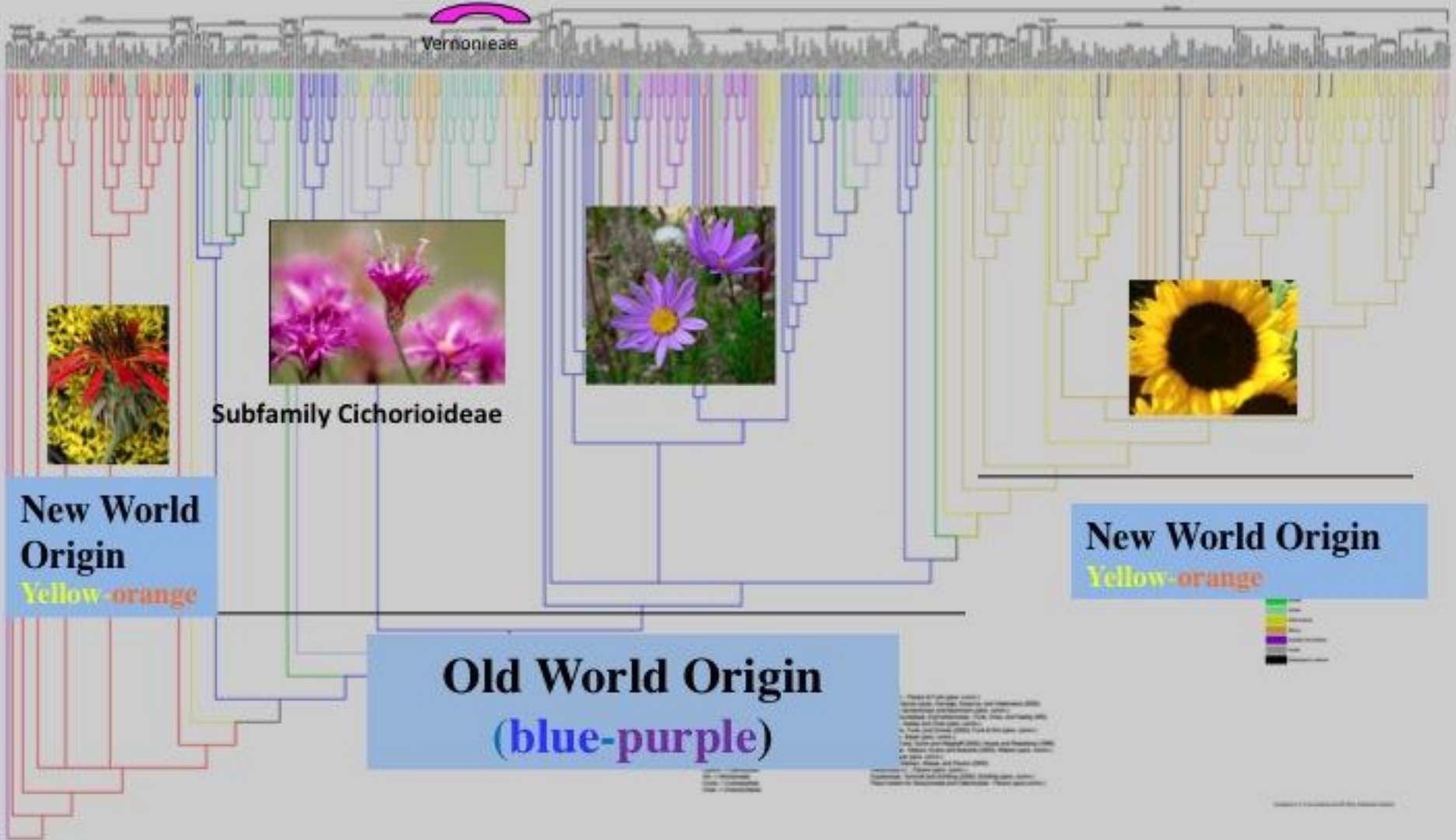


South American Compositae Meeting
FAPESP - 5-7th December 2011



Compositae Supertree

(from Funk in Funk et al., 2009)



Vernonieae

Subfamily Cichorioideae



- **Two centers of diversity:**
 - Brazil
 - East Africa
- **1500-2000 species worldwide-
mostly tropical**
- **~130 genera, 21 subtribes**
- **>70% monotypic or ≤ 2 species**



Hawaii



Asia



Africa



Central America



South America



Thailand



Madagascar



India



West Indies



Eastern North America



Brazil



Marshes



Tepui



Cloud Forest



Caatinga



Savannah & Grassland



Soil Types



Islands



Campo Rupestre



3-5m



5cm

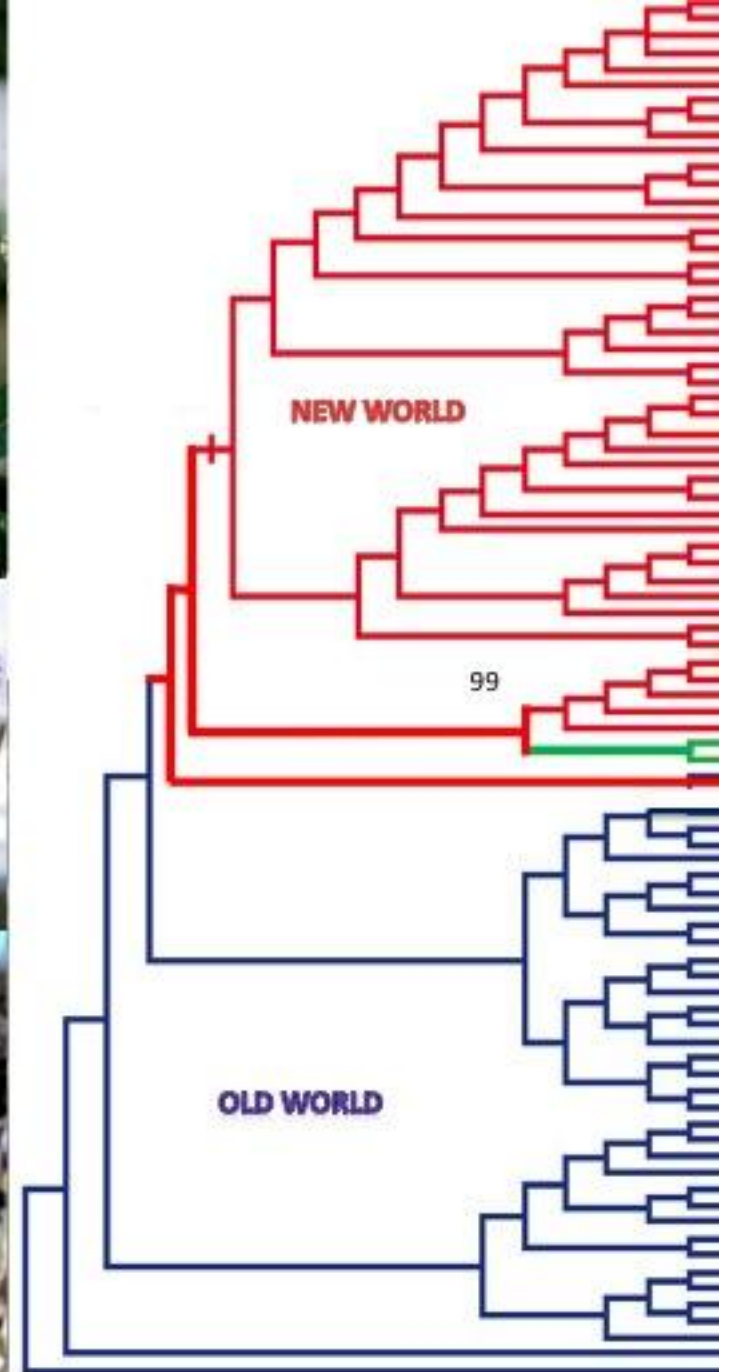


1.5m



30m

New World Vernonieae



Methodology



Phylogeny: 300+ taxa, 3800bp DNA sequence:
Nuclear ITS and cpDNA trnI-F, ndhF, matK—
Bayes, ML, MP



Dating: r8s nprs, BEAST, 6 dated nodes (fossils,
islands), 50 mil MCMC gens



Ancestral Area Reconstruction: Bayes MCMC,
s-DIVA in RASP

Niche Modeling: ARC GIS, GBIF collection data,
MaxEnt, ENMtools

Lepidaploinae

- 14 genera, >250 species
- Widespread in Neotropics
- *Lessingianthus* and *Lepidaploa*, >225 species



Echinocoryne holosericea



Chrysolea flexuosa

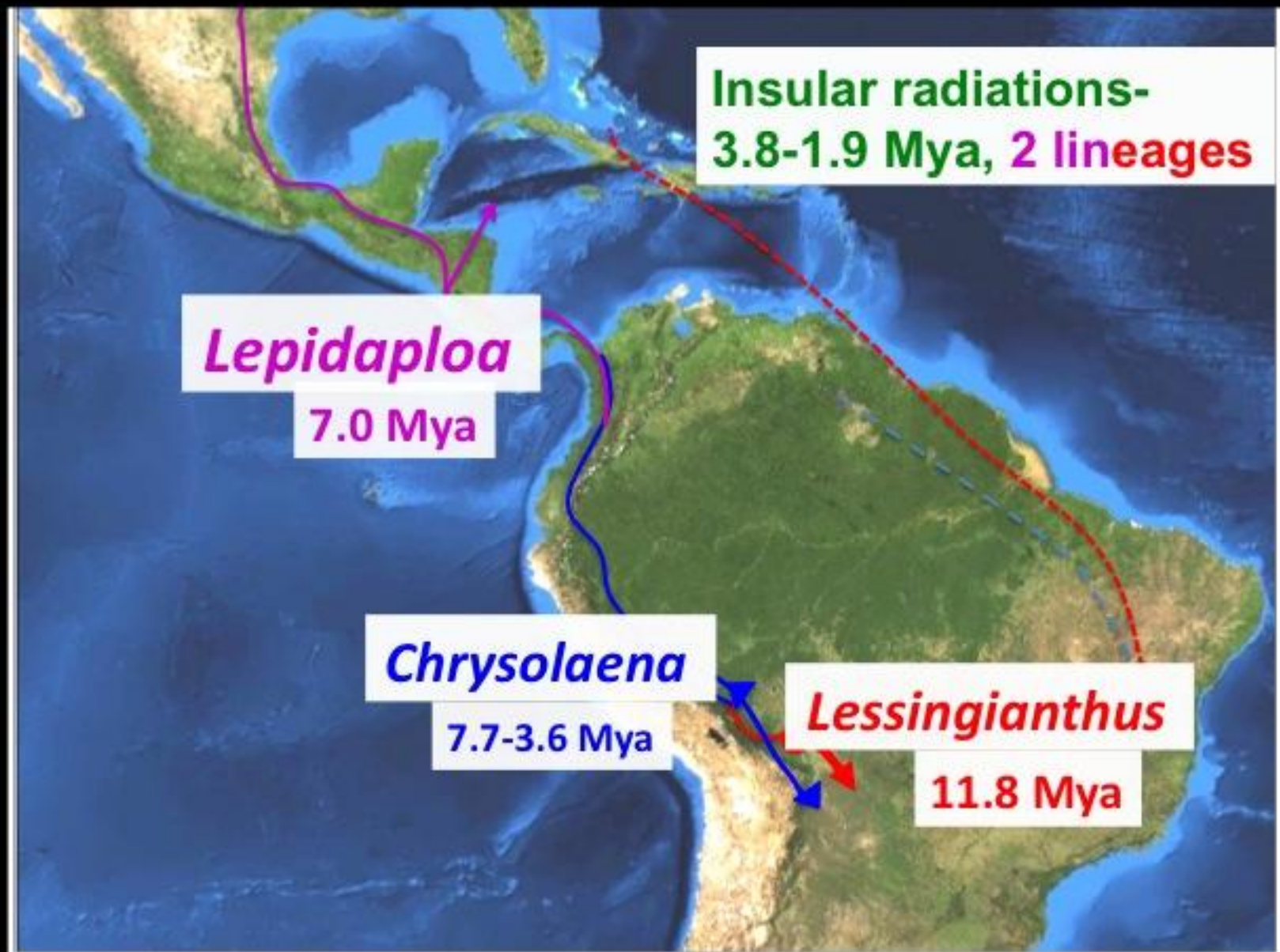


Lepidaploa salzmanii



Lessingianthus laurifolia

Lepidaploineae 18.2 Mya-present



5-0 Mya

Lepidaploa

7.0 Mya

Chrysoleaena

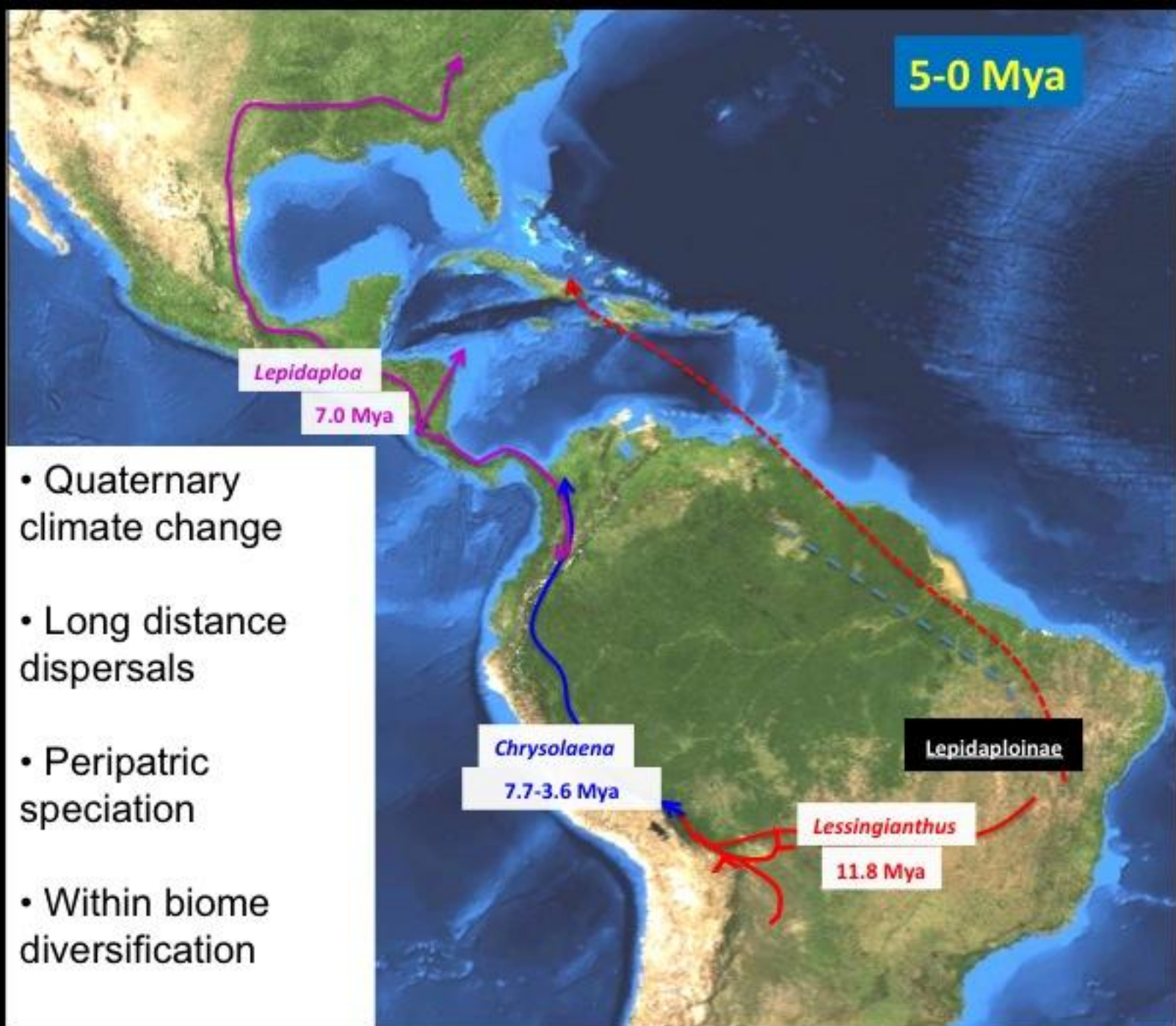
7.7-3.6 Mya

Lessingianthus

11.8 Mya

Lepidaploinae

- Quaternary climate change
- Long distance dispersals
- Peripatric speciation
- Within biome diversification



Lessingianthus project for you?

- Within Biome (Cerrado) research needed.....over 115sp.
- How did Quaternary climate change affect the distribution and evolution of *Lessingianthus* in Cerrado?



Lessingianthus laurifolia



Vernoniinae

- 9 genera, >200 species
- Widespread in Neotropics
 - found in eastern North America
- *Vernonanthura*, *Vernonia*, others with ≤ 10 species each



Vernonanthura alamanii



Vernonanthura patens



Vernonia acaulis



Vernonia glabra

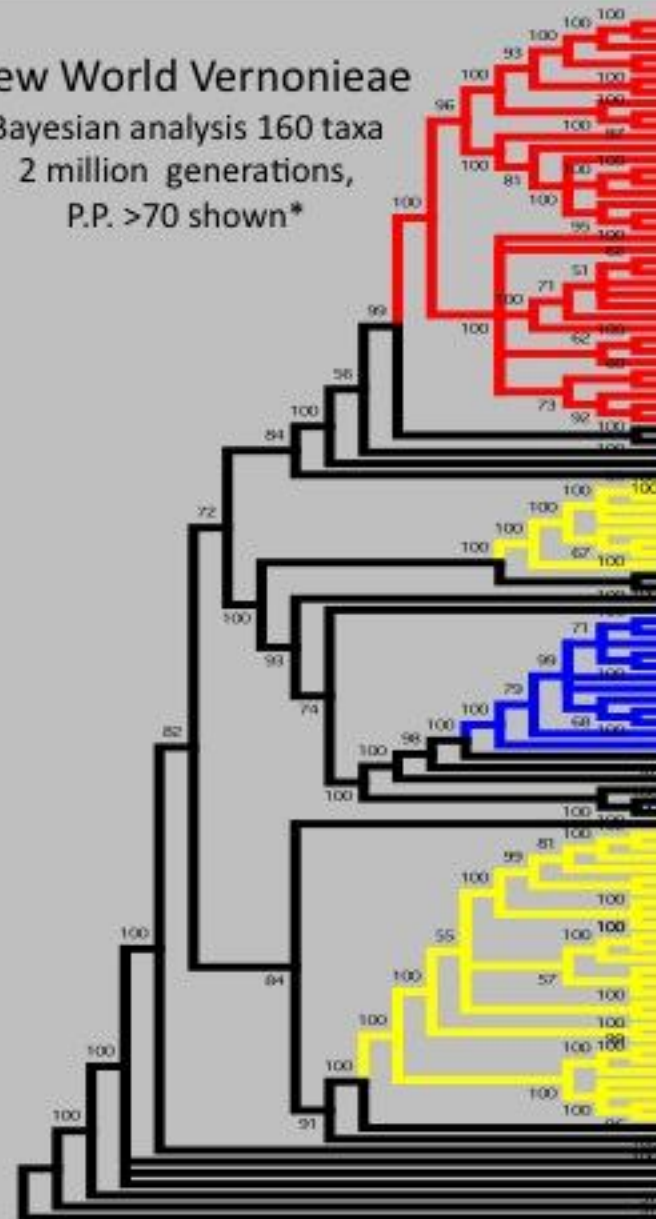


Vernonanthurus



Lepidaploa

New World Vernoniaceae
Bayesian analysis 160 taxa
2 million generations,
P.P. >70 shown*



Vernoniinae

Lepidaploinae

Vernoniinae: Central American Origin

- Dispersal in 3 directions
- Only frost-tolerant lineage
 - eastern North America
- Derived from Chrestinae



Piptocarphinae: Andes and montane Mexico

- 10 genera, >60 species
- *Critoniopsis*, *Eremosis*



Critoniopsis



Piptocarpha, *Pollalesta*



Eremosis



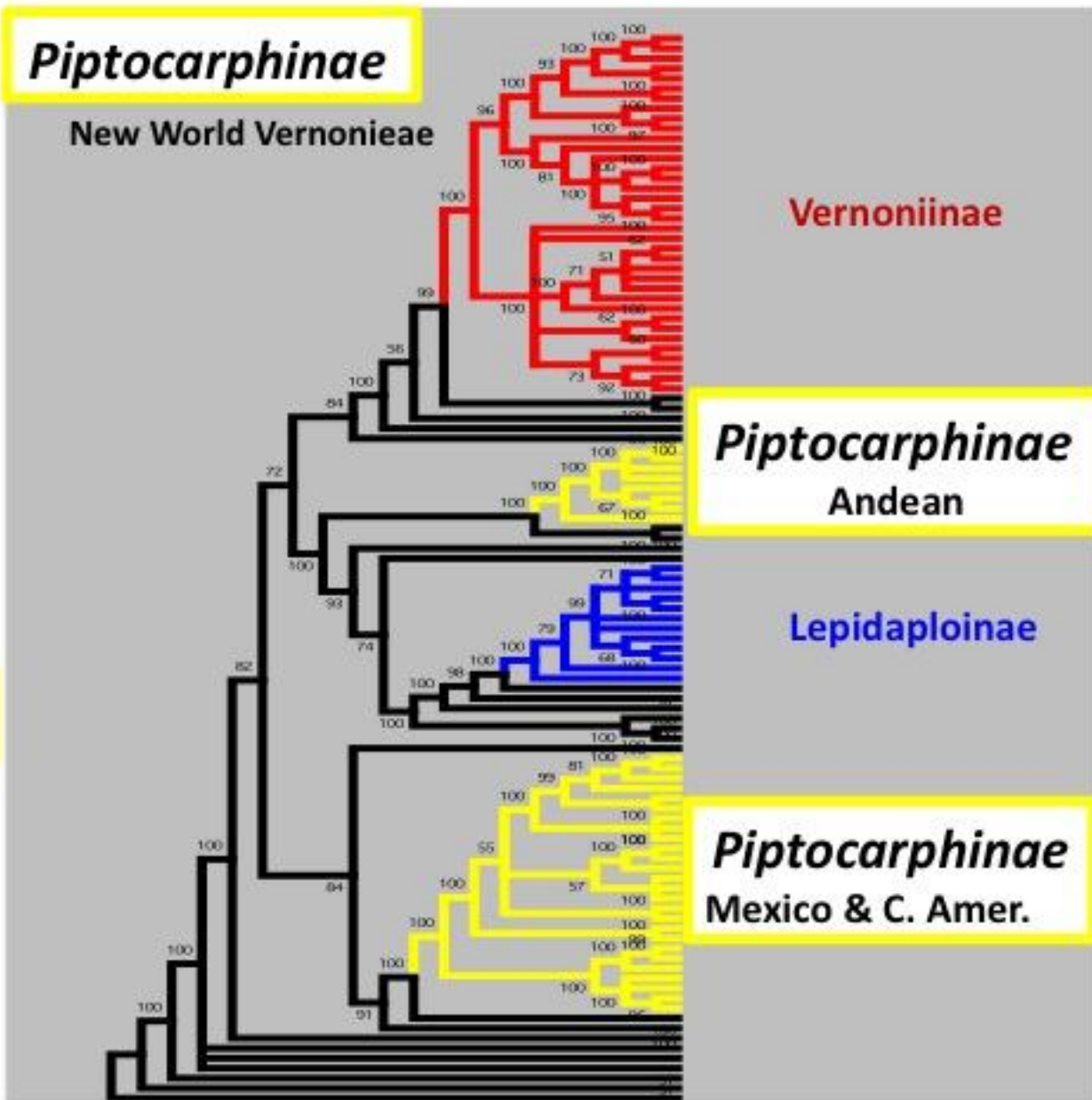
Vernonanthur



Critoniopsis, Eremosis



Lepidaploa



Critoniopsis and Eremosis

- Independent lineages with convergent morphologies
- Andean and Mexican Cordilleras
- Non-overlapping distribution



~ 26 Mya to present

Dipertocypselinae
Lychnophorinae
Mesanthophorinae
Piptocarphinae
Rolandrinae
Sipolisiinae

Lepidaploinae

Elephantopinae

**Chrestinae &
Vernoniinae**

Critoniopsis

**Eremosis &
Leiboldiinae**

Brazil



Environmental Niche Models

Rainfall, Precipitation, Elevation: Modeled in MaxEnt



Climate Change: Potential Habitat 2080

IPCC Climate change model A2



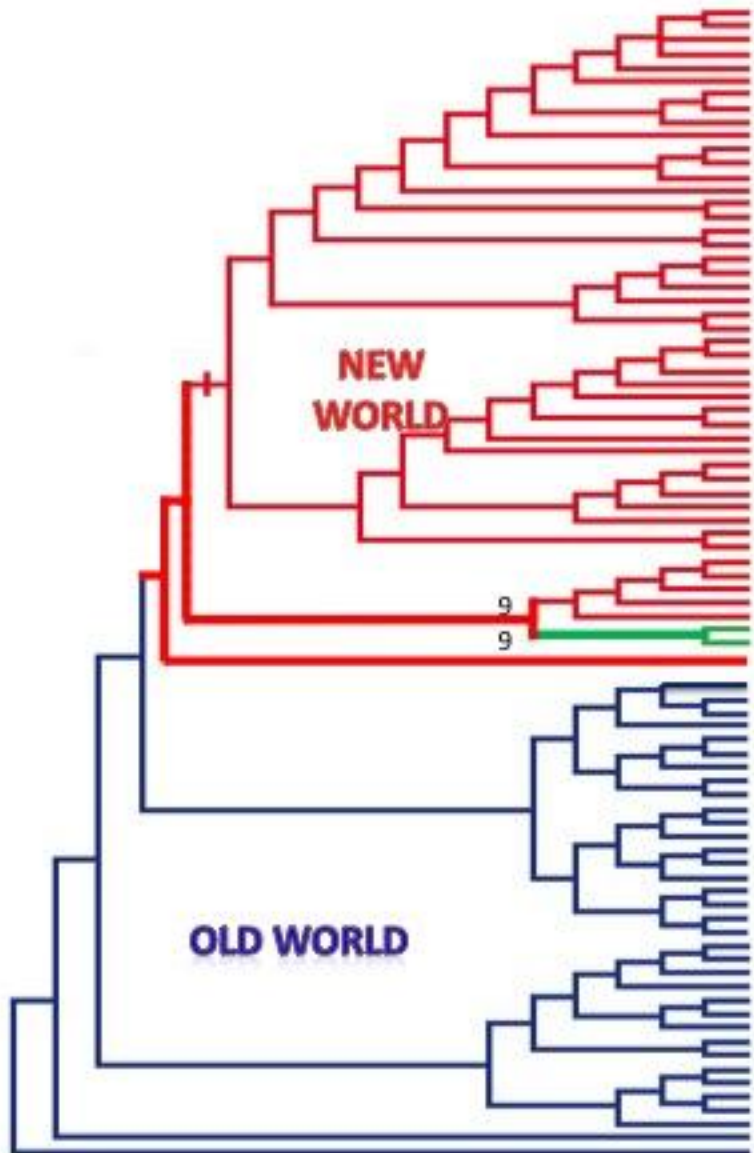
Vernoniinae

77% New
Habitat
10% Loss

Lepidaploinae

8% New Habitat
55% Loss

New World to Old World Back dispersal



New World
Leboldiinae



New World
Eremosis



South East Asia
Strobocalyx Tarlmounia

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HEY, IT'S TRUE! ABOVE THE EQUATOR, THE FUNERALS GO CLOCKWISE!

