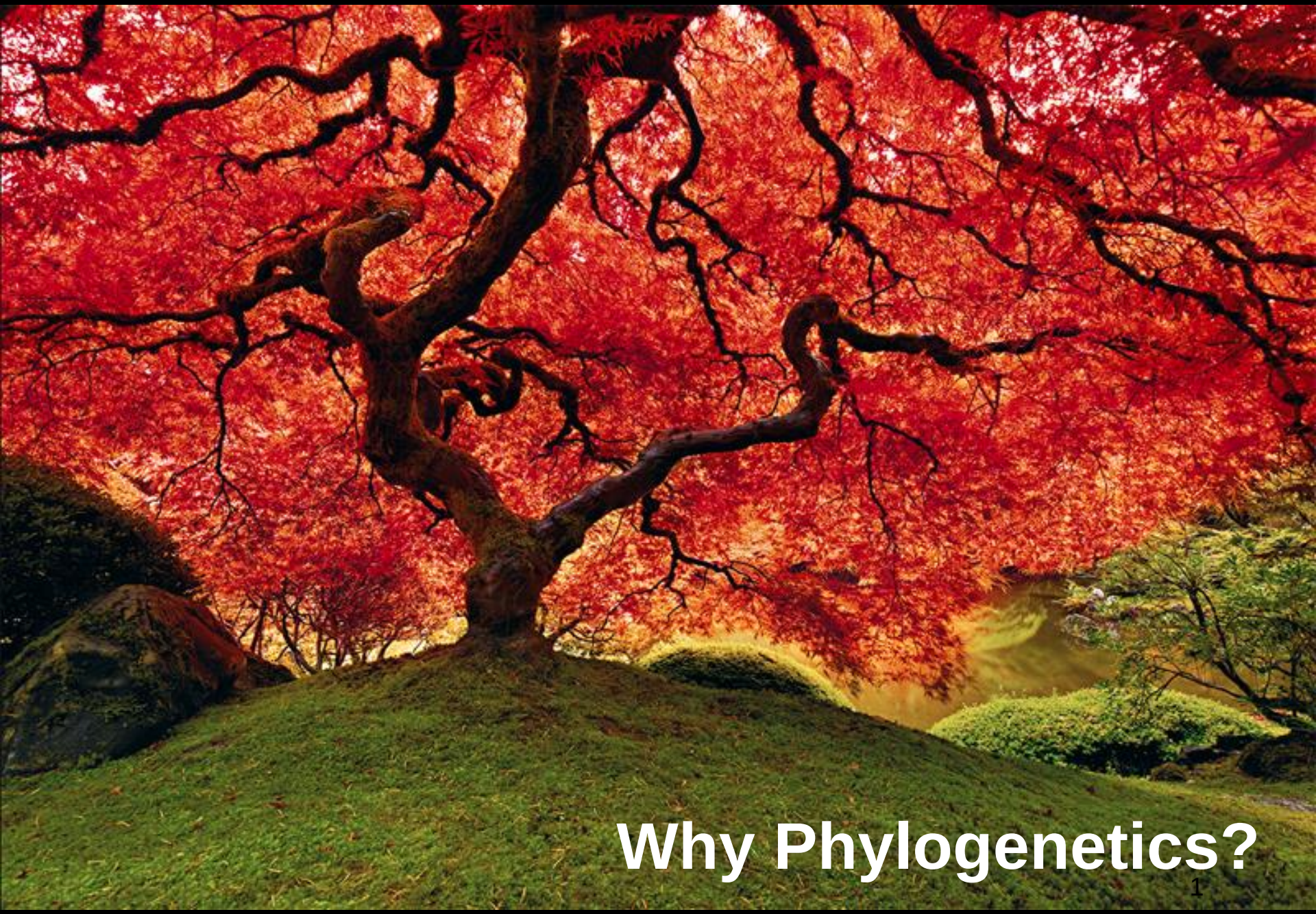
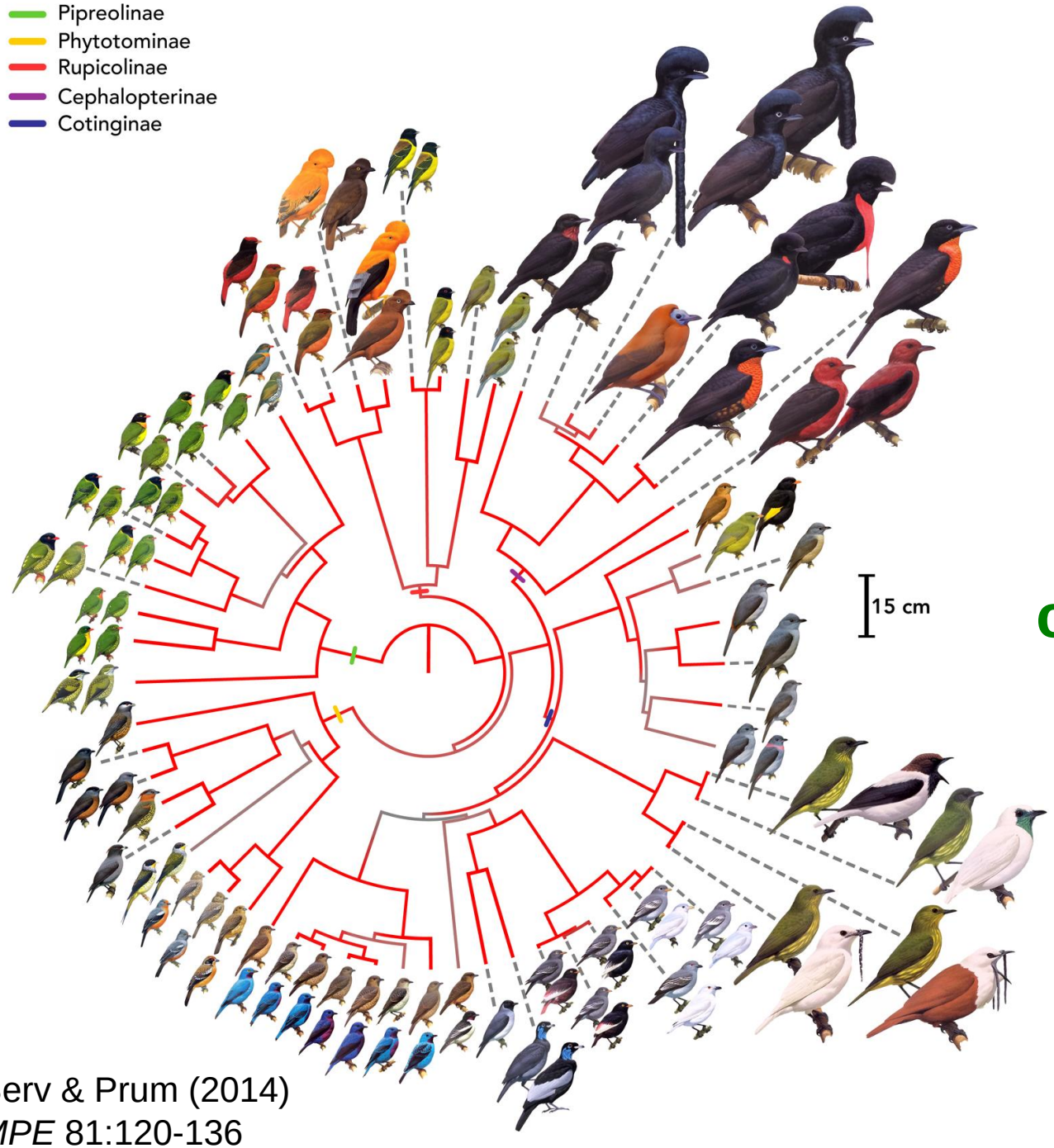


Peter Lik, *Tree of Life*



What do you see?

What do you think the ancestral coloration was?

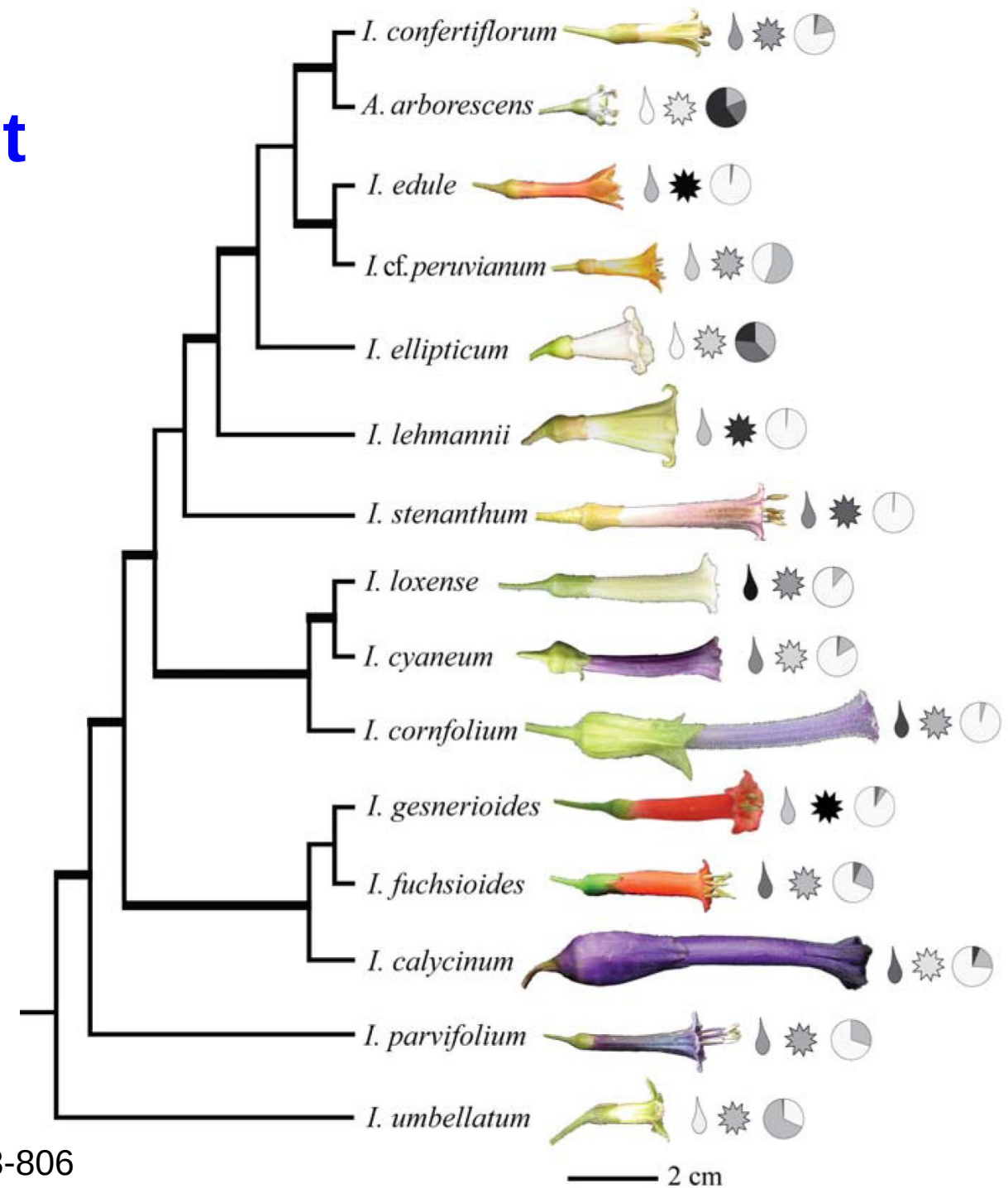
What about crests?

Berv & Prum (2014)
MPE 81:120-136

Phylogenetics and complex trait evolution: *Iochroma*

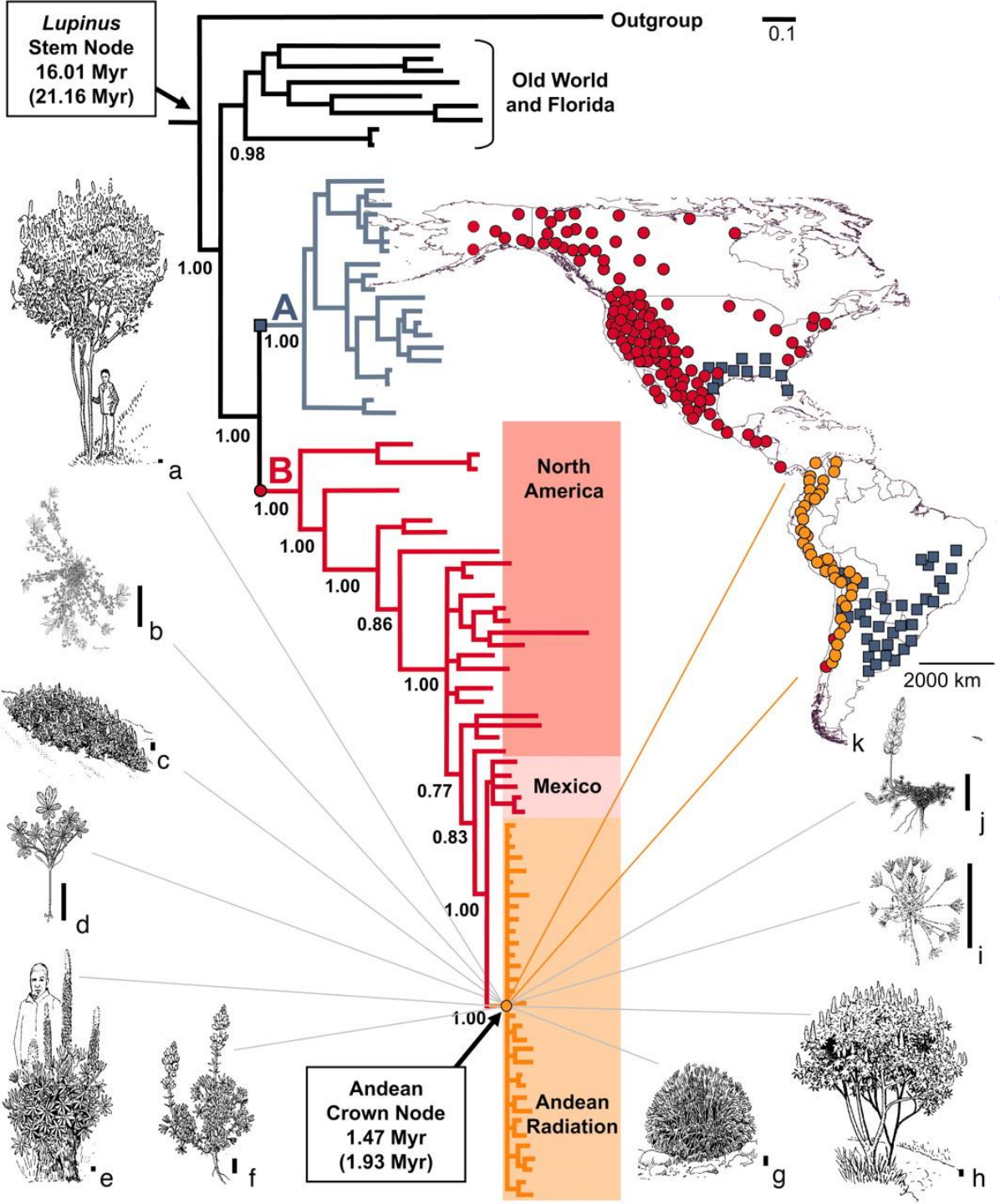
How many times have red flowers evolved?

What about purple flowers?

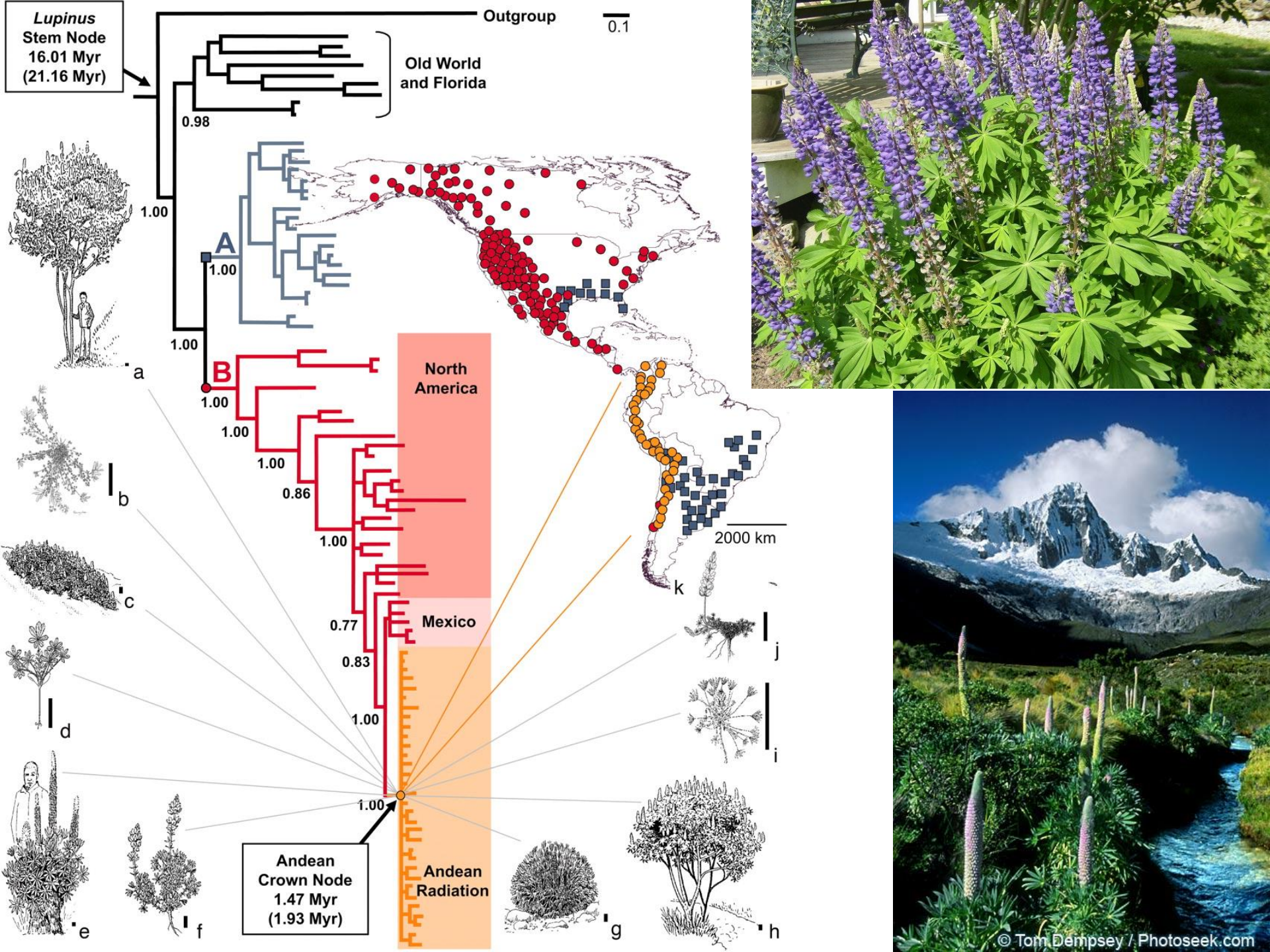


Smith et al. (2008) *Evolution* 62:793-806

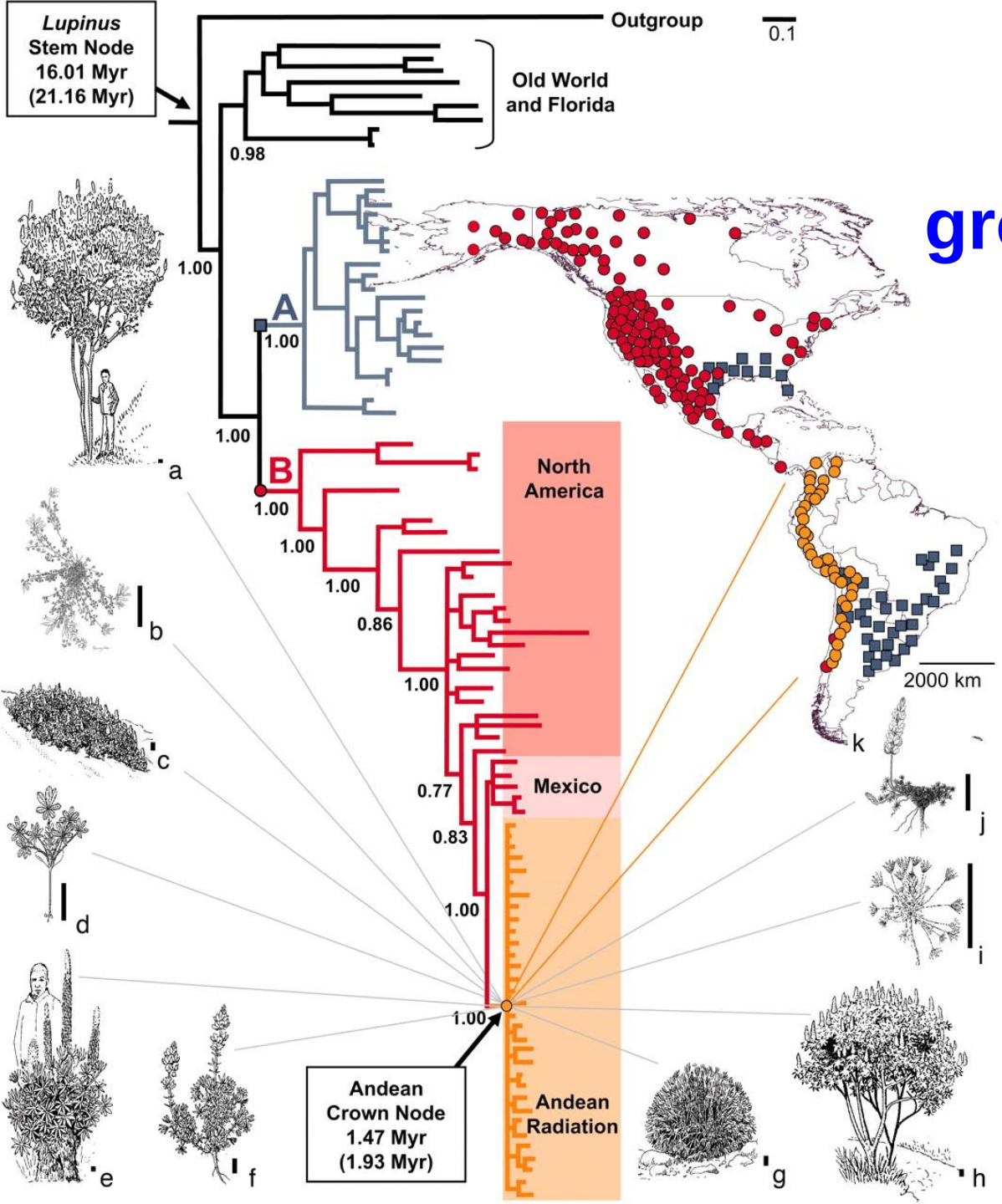
Phylogenetics, biogeography, evolution, and molecular dating: lupines



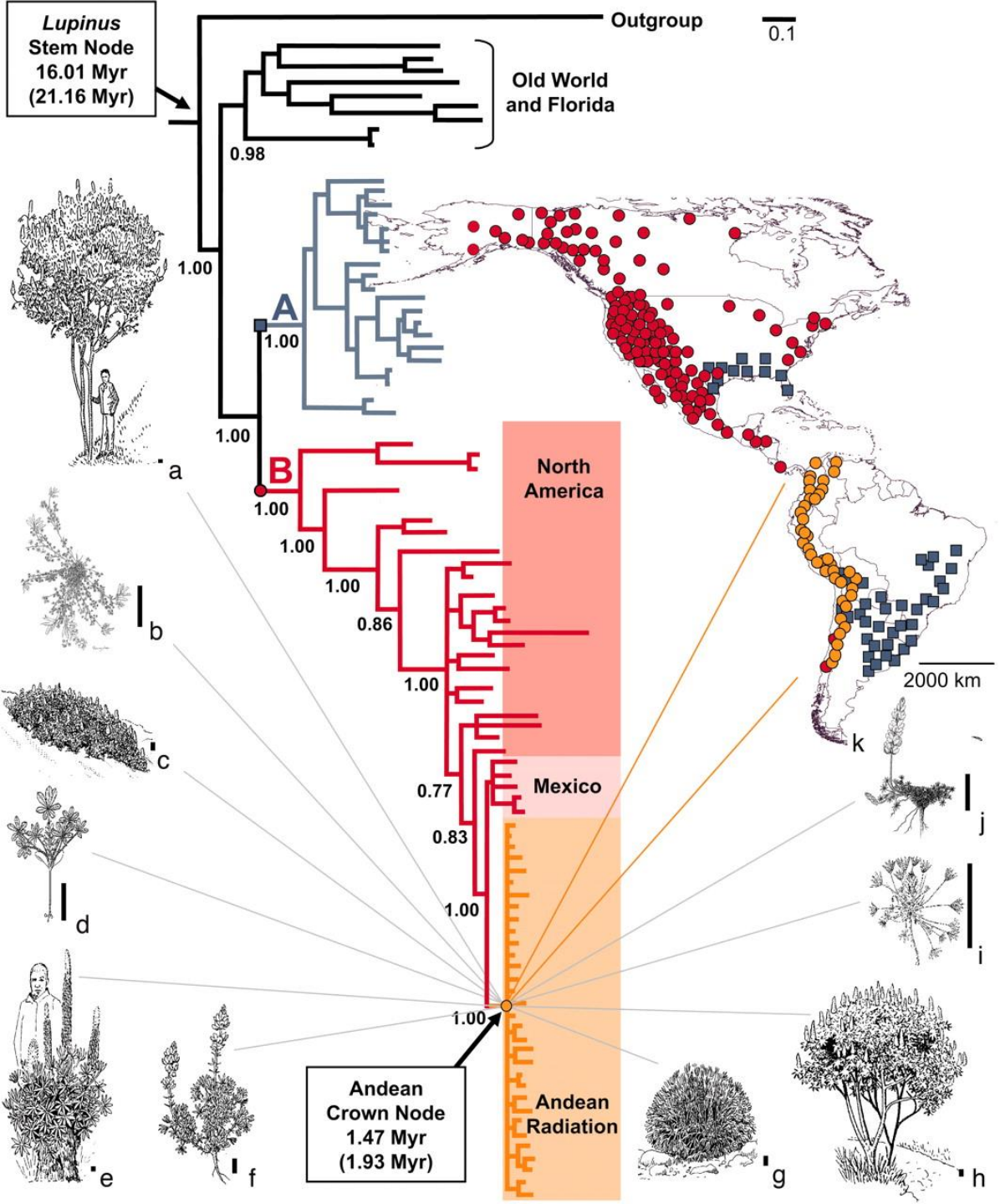
Hughes & Eastwood (2006)
PNAS 103:10334-10339


Lupinus
Stem Node
16.01 Myr
(21.16 Myr)
Outgroup
0.1
Old World
and Florida
0.98
1.00
A
1.00
1.00
B
1.00
1.00
1.00
0.86
1.00
North
America
2000 km
0.77
Mexico
0.83
1.00
1.00
Andean
Crown Node
1.47 Myr
(1.93 Myr)
Andean
Radiation
a
b
c
d
e
f
g
h
i
j
k
© Tom Dempsey / Photoseek.com

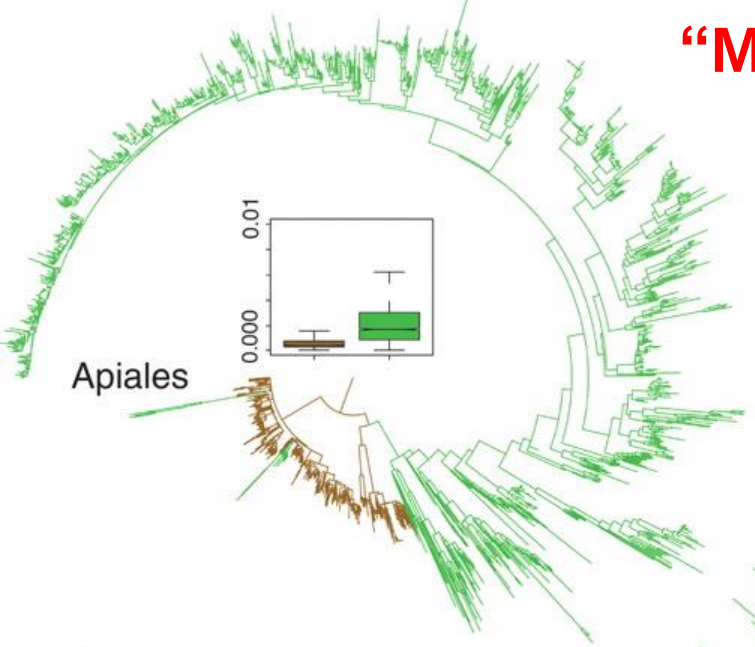
Lupines have a huge diversity of growth forms in the Andes!

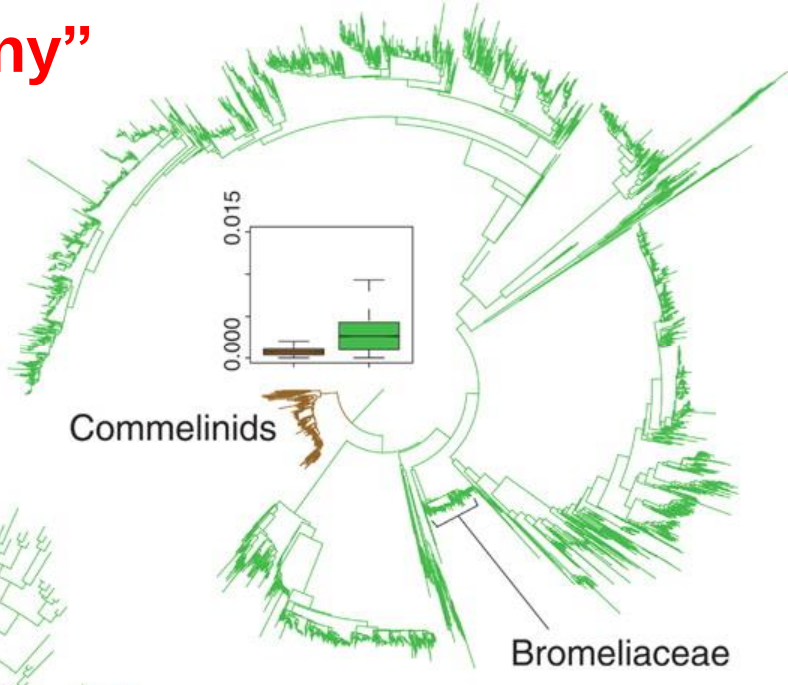


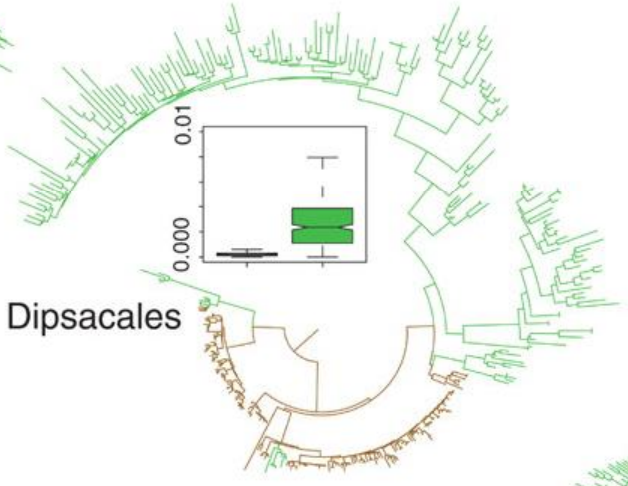
Andean lupines speciated explosively

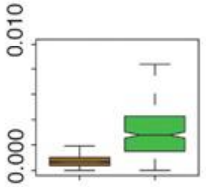


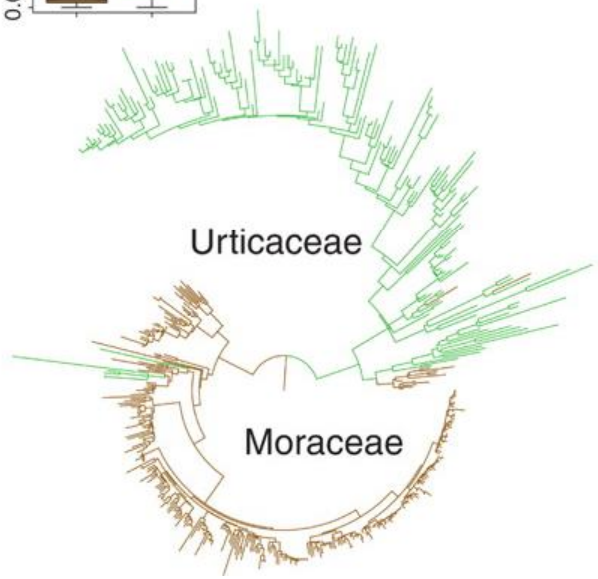
"Megaphylogeny" approach











Variation in evolutionary rate based on life history

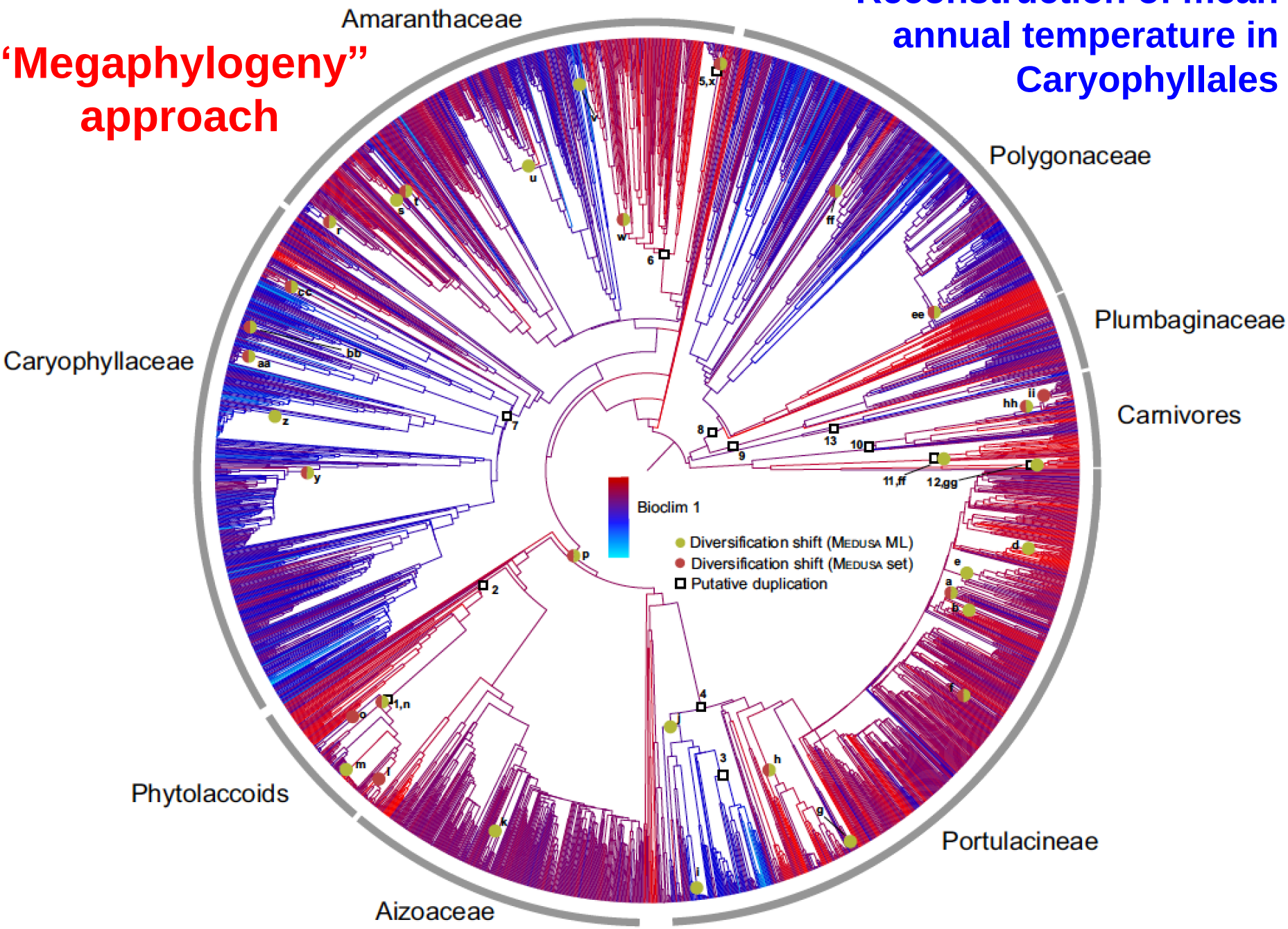
brown = woody

green = herbaceous

Smith & Donoghue (2008) *Science* 322:86-89

“Megaphylogeny” approach

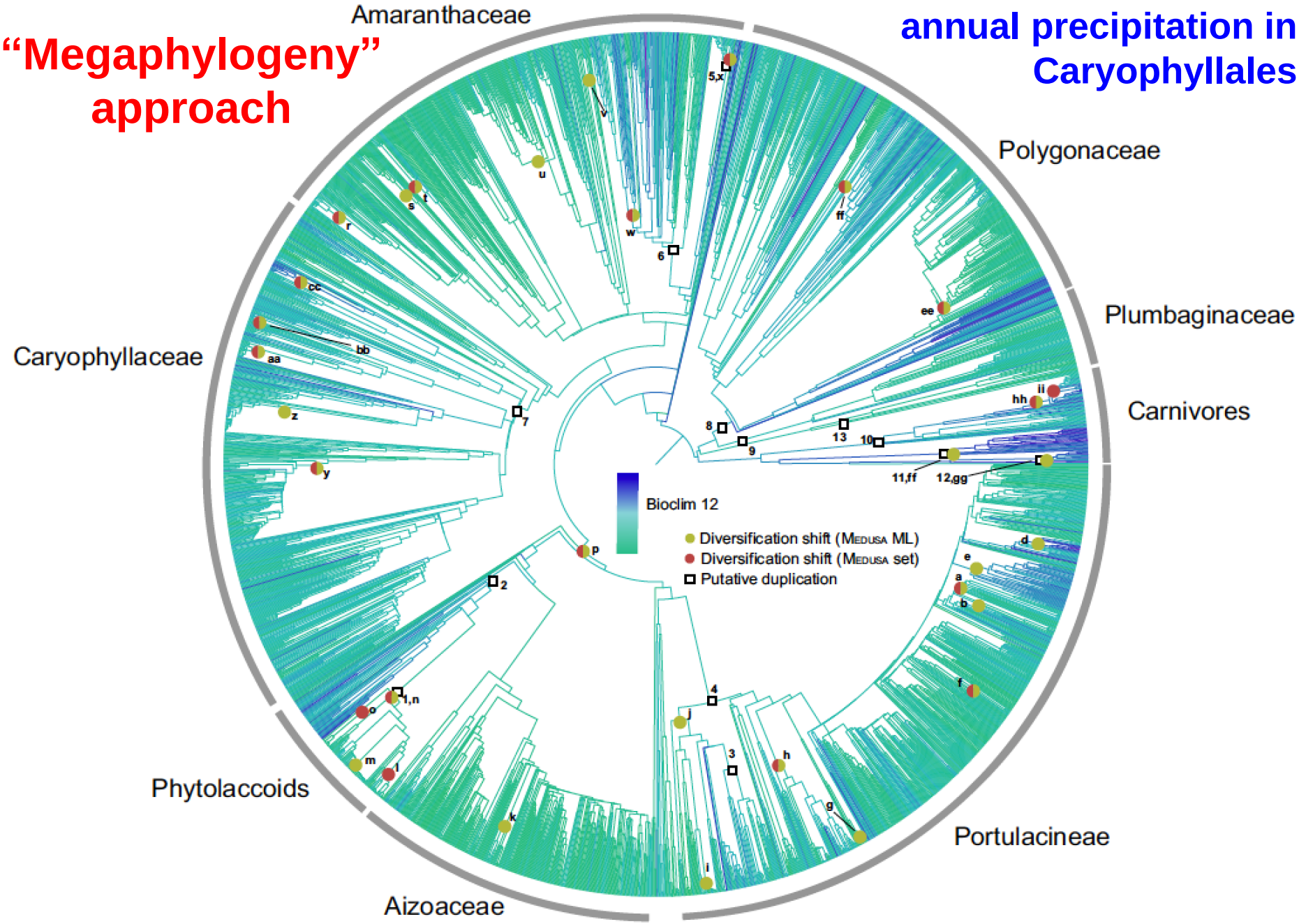
Reconstruction of mean annual temperature in Caryophyllales



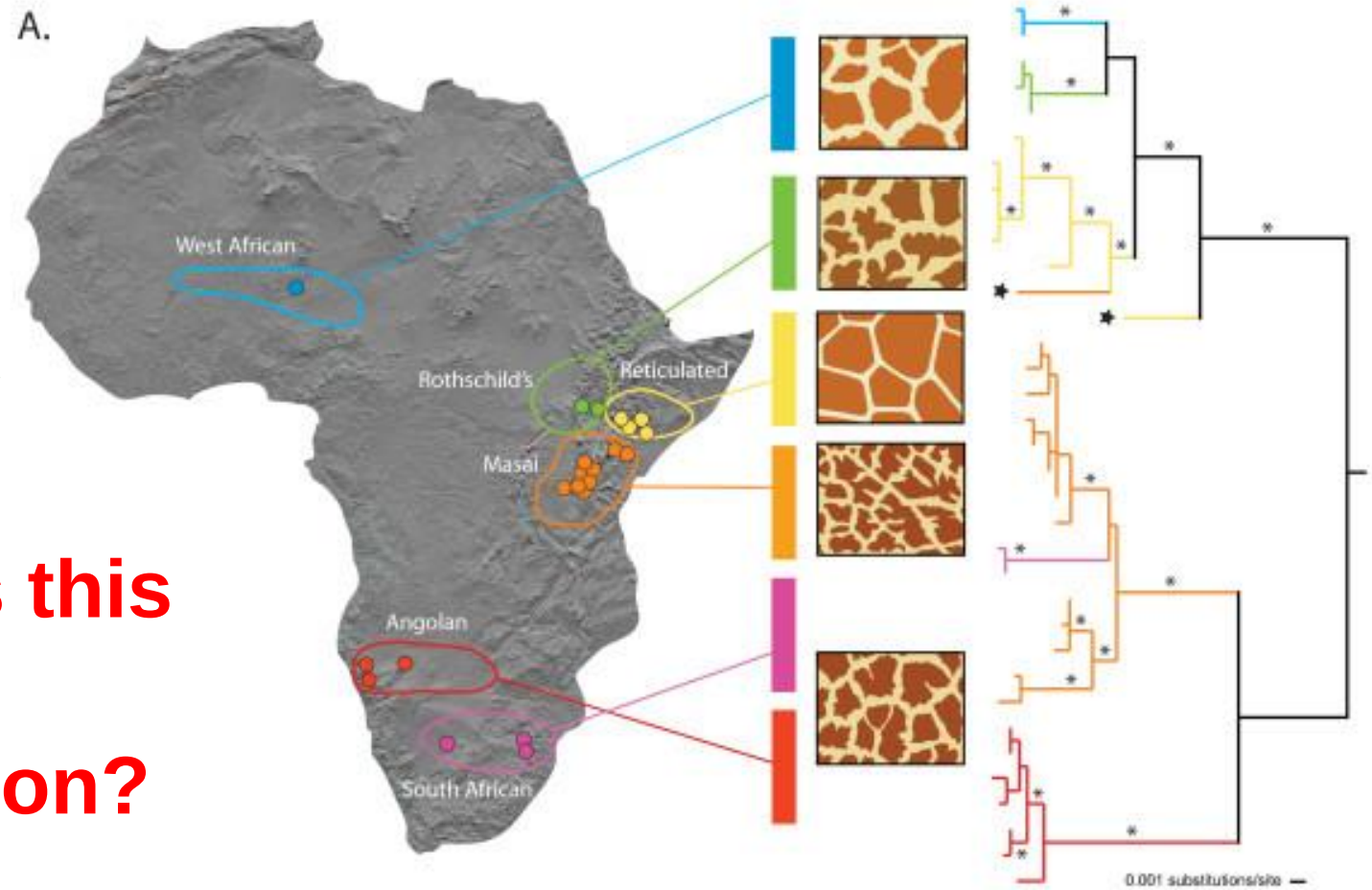
Smith et al. (2018) *New Phytologist* 217:836-854

“Megaphylogeny” approach

Reconstruction of mean annual precipitation in Caryophyllales



Smith et al. (2018) *New Phytologist* 217:836-854



How many species?

What does this mean for conservation?

Phylogenetics and conservation biology: giraffes

Brown et al. (2007) *BMC Biol.* 5:57

Learning about gypsum endemism: *Nama*

ITS

gypsum shrub clade (10 taxa; 8 endemics)

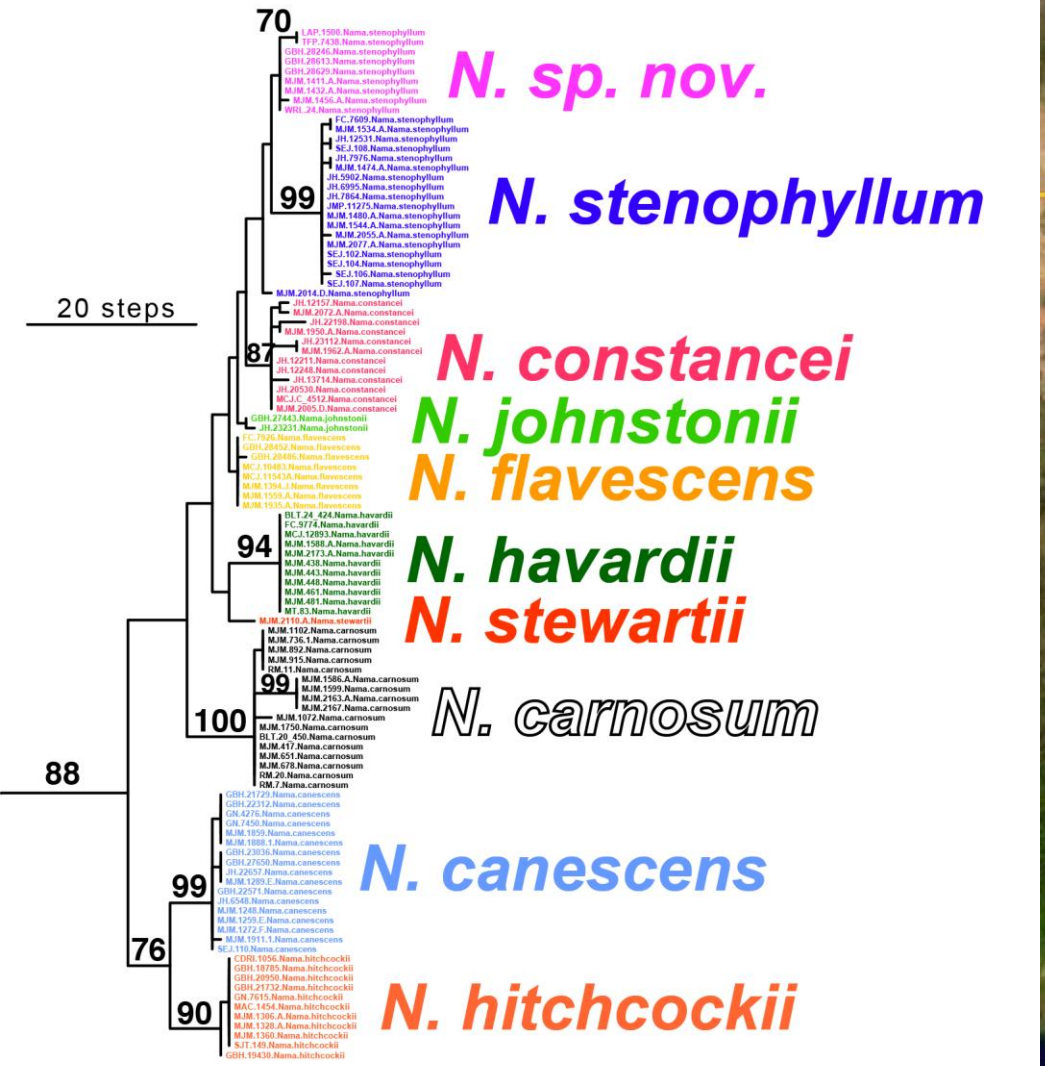
Nama

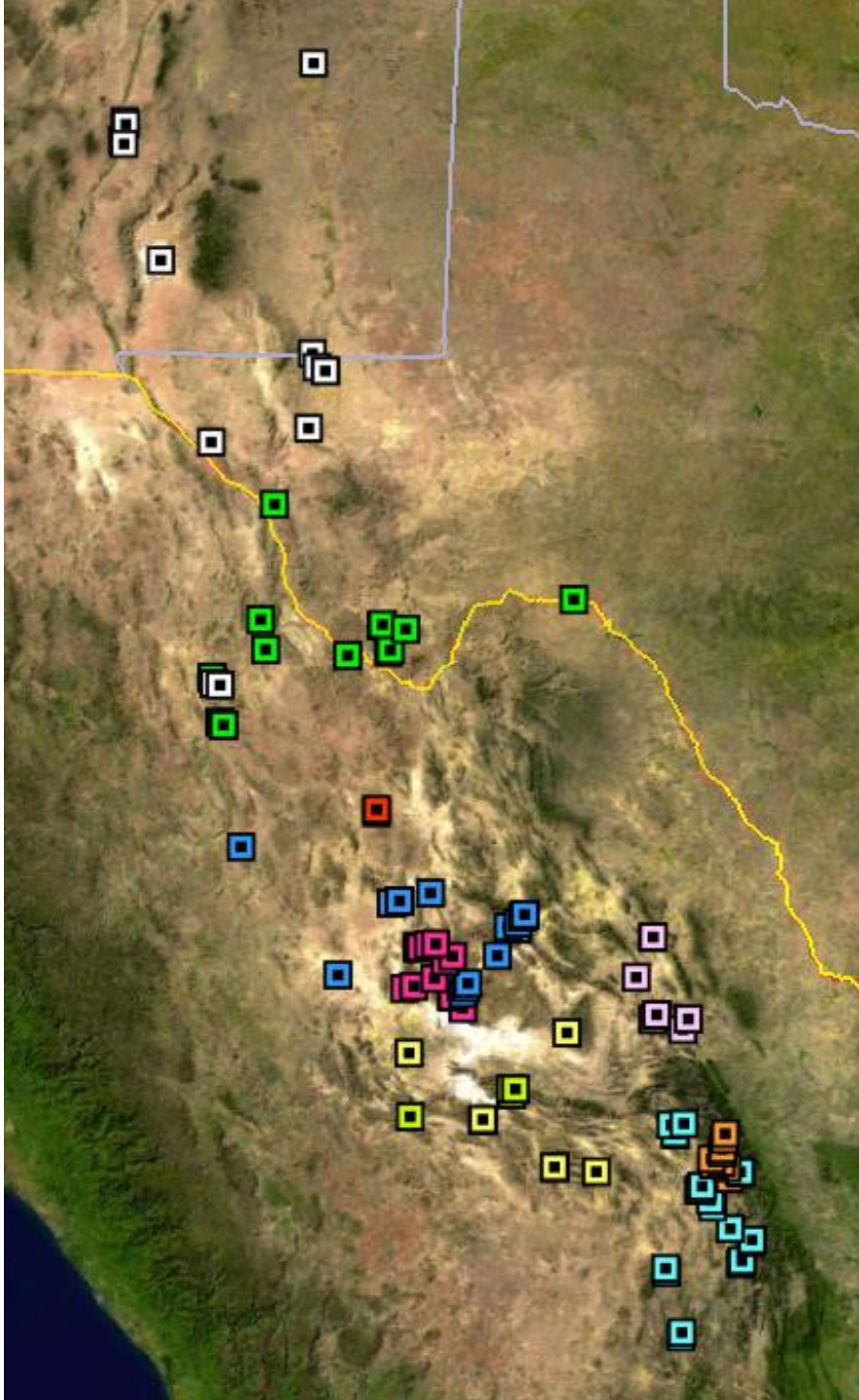
N. stevensii

Reversal to non-endemism?

20 steps

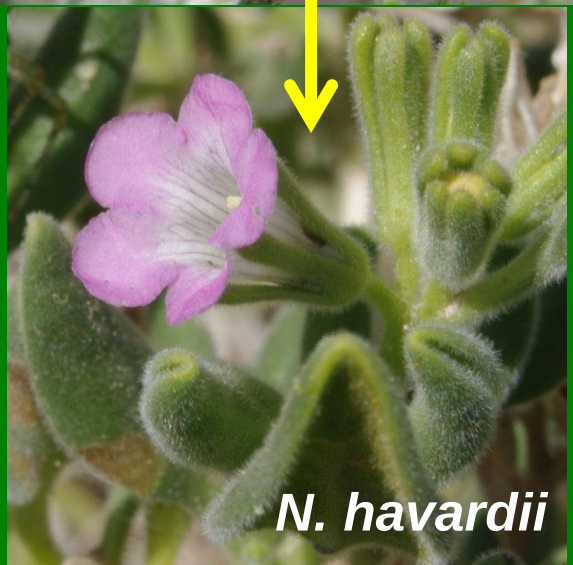
In gypsum endemic clades, allopatric speciation is the norm

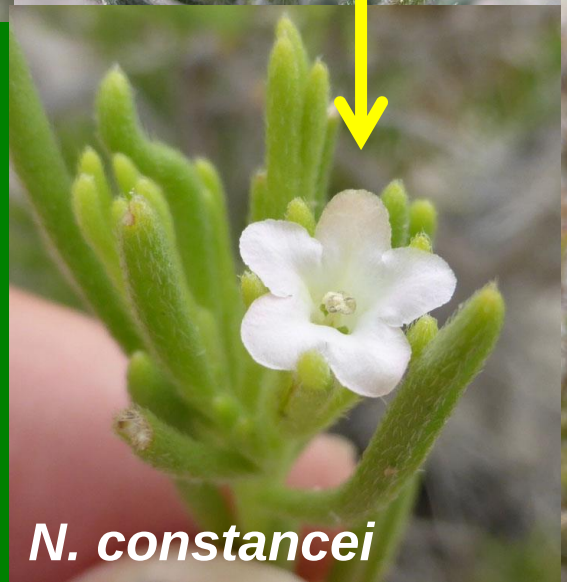


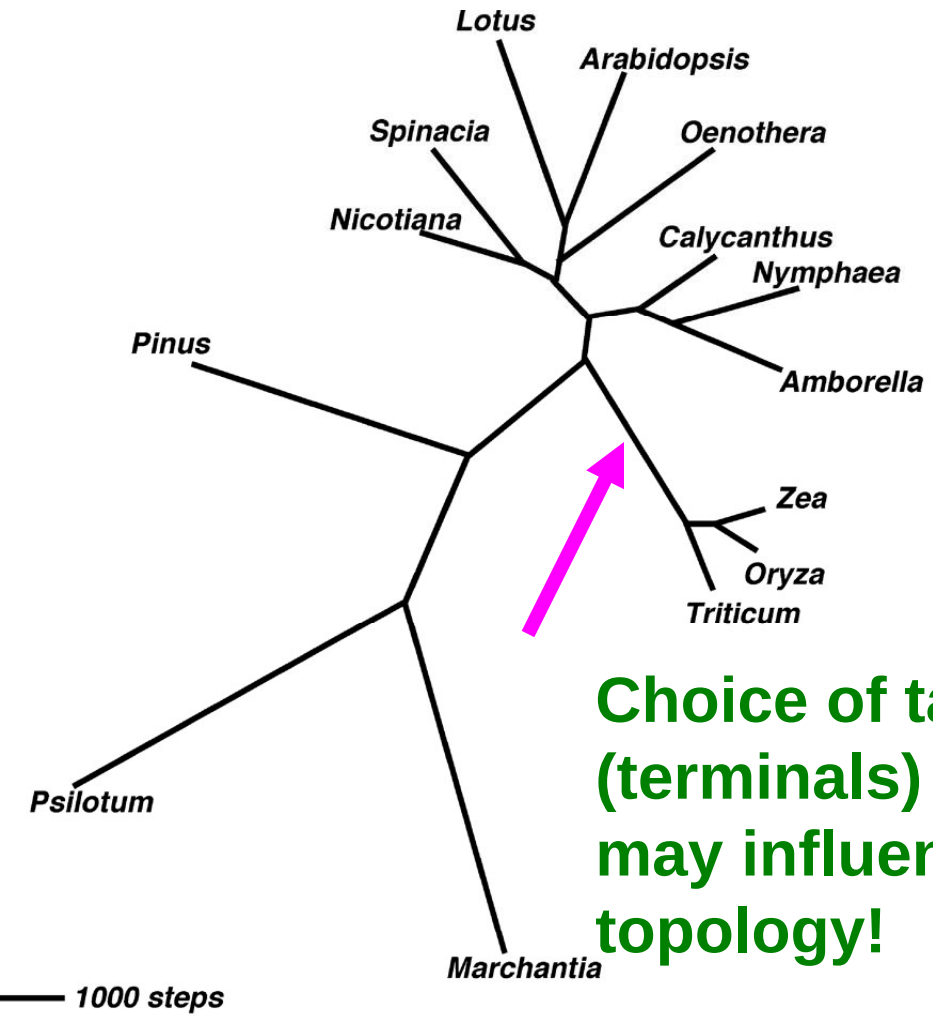


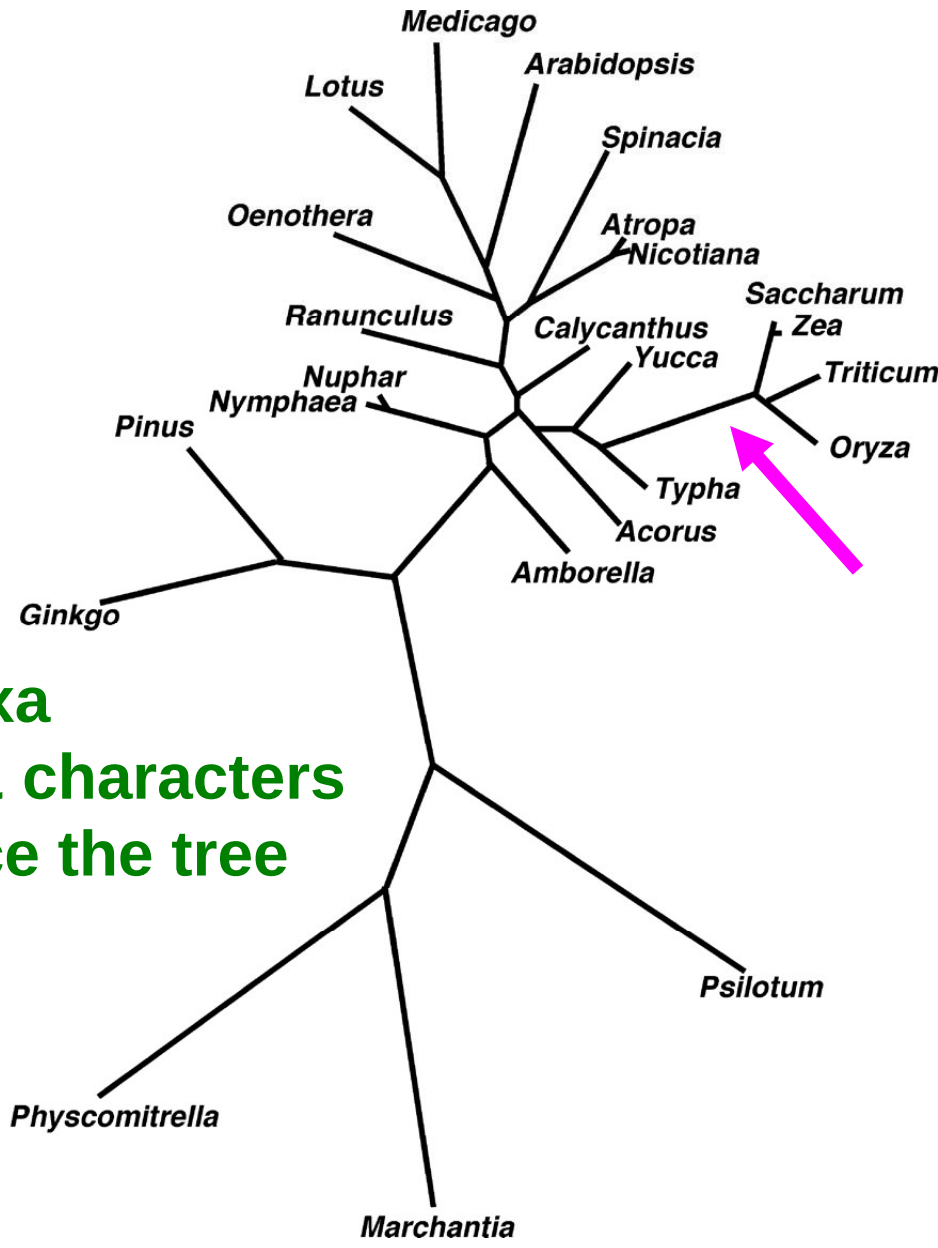
But sympatry does occur!

Floral divergence is typical in sympatric taxa within the same gypsum clade







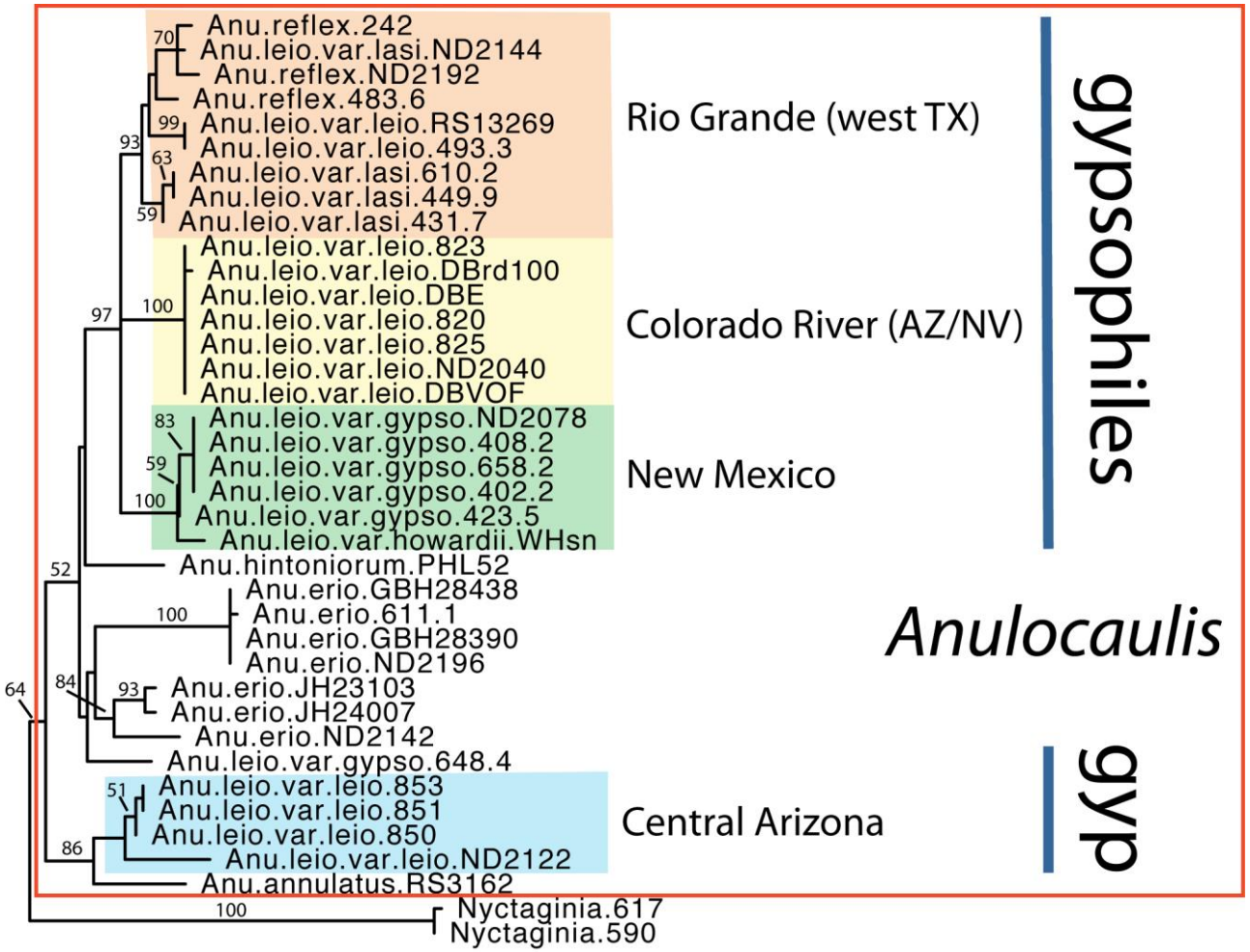


Choice of taxa (terminals) & characters may influence the tree topology!

Why do angiosperms have a long branch? Grasses?

You must be careful– phylogenetics can be filled with traps

Leebens-Mack et al. (2005)
MBE 22:1948-1963

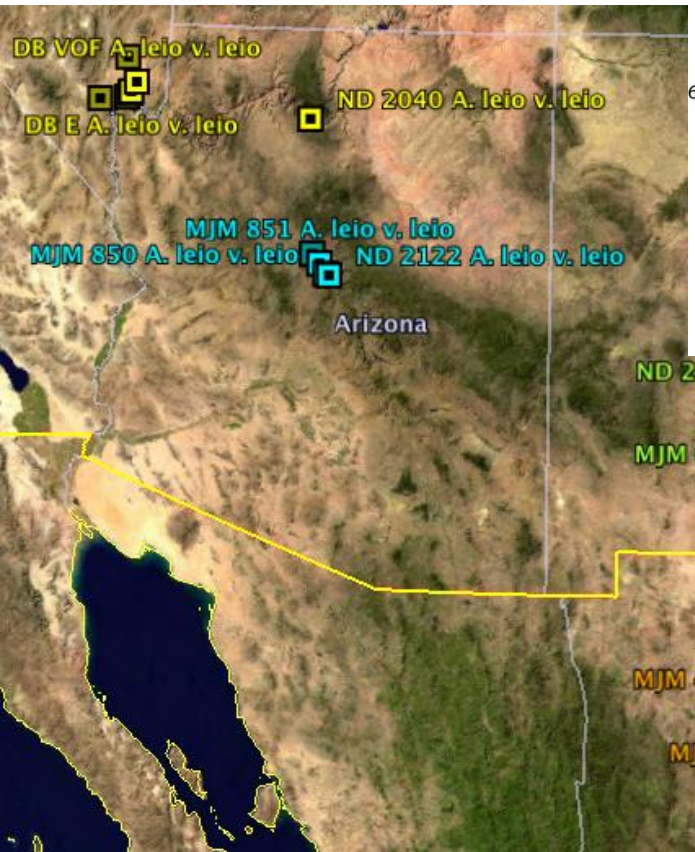


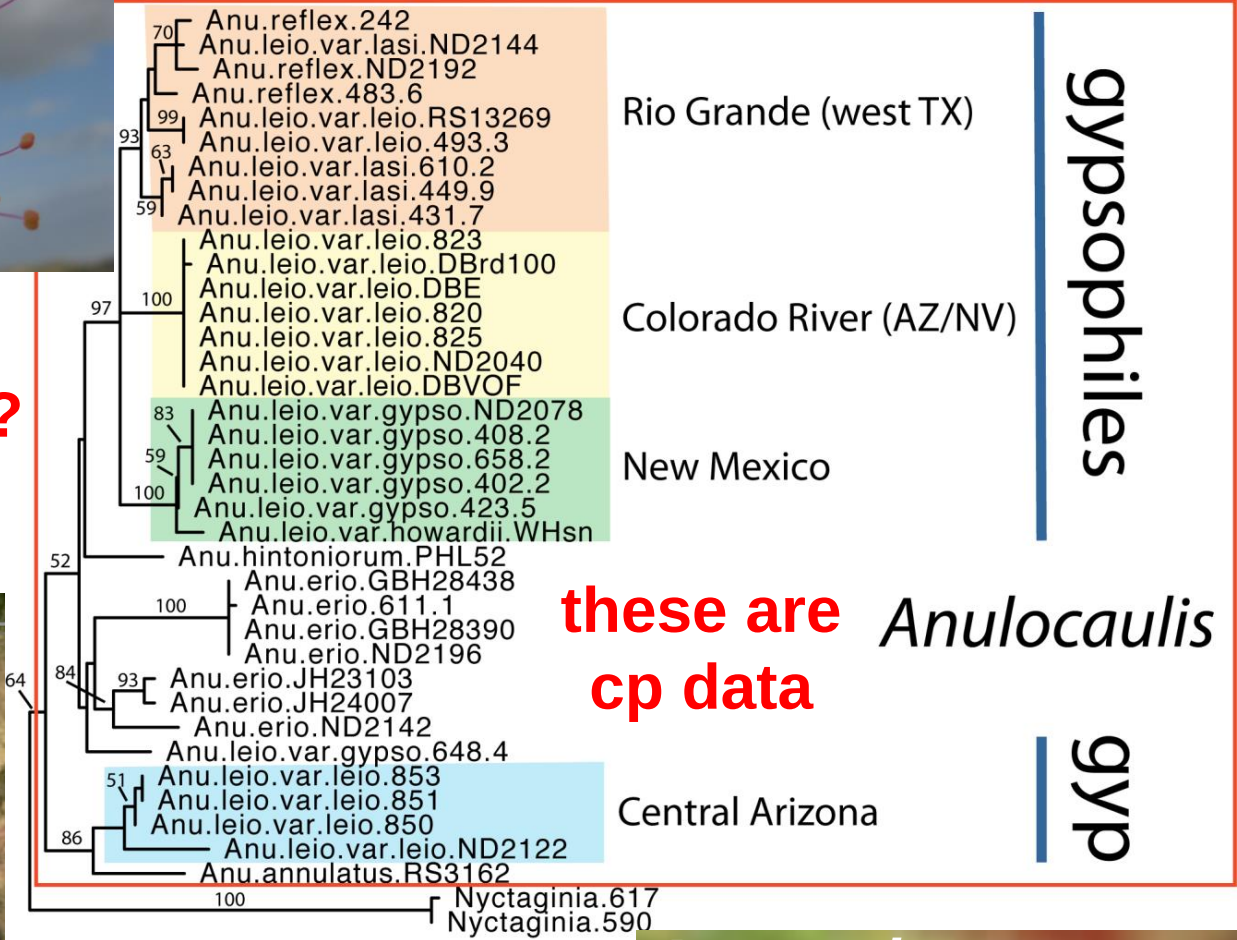
Example 2: Among close relatives

You must be careful–
phylogenetics can be filled with traps

What does species non-monophyly mean?

Should we panic?

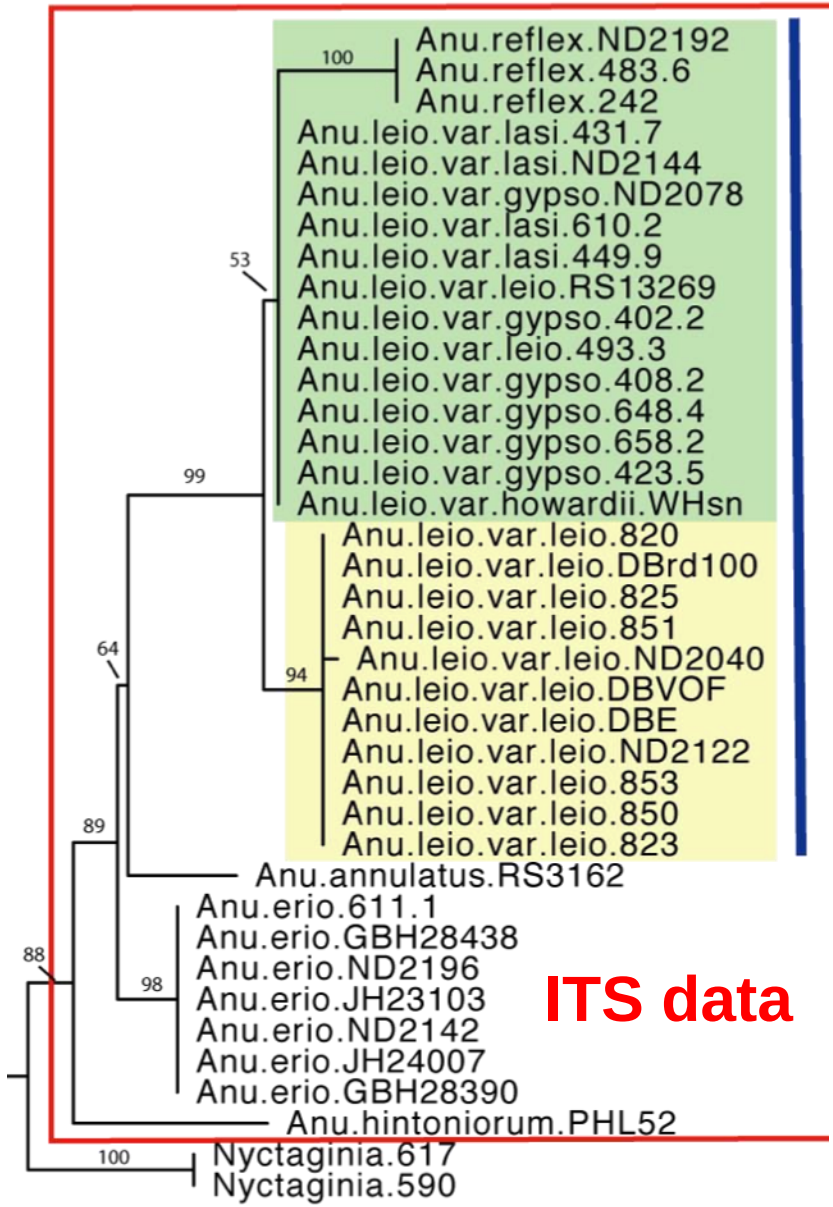




these are cp data

What about a nuclear locus?

How could cp and ITS be so different?



ITS data

gene trees vs. species tree