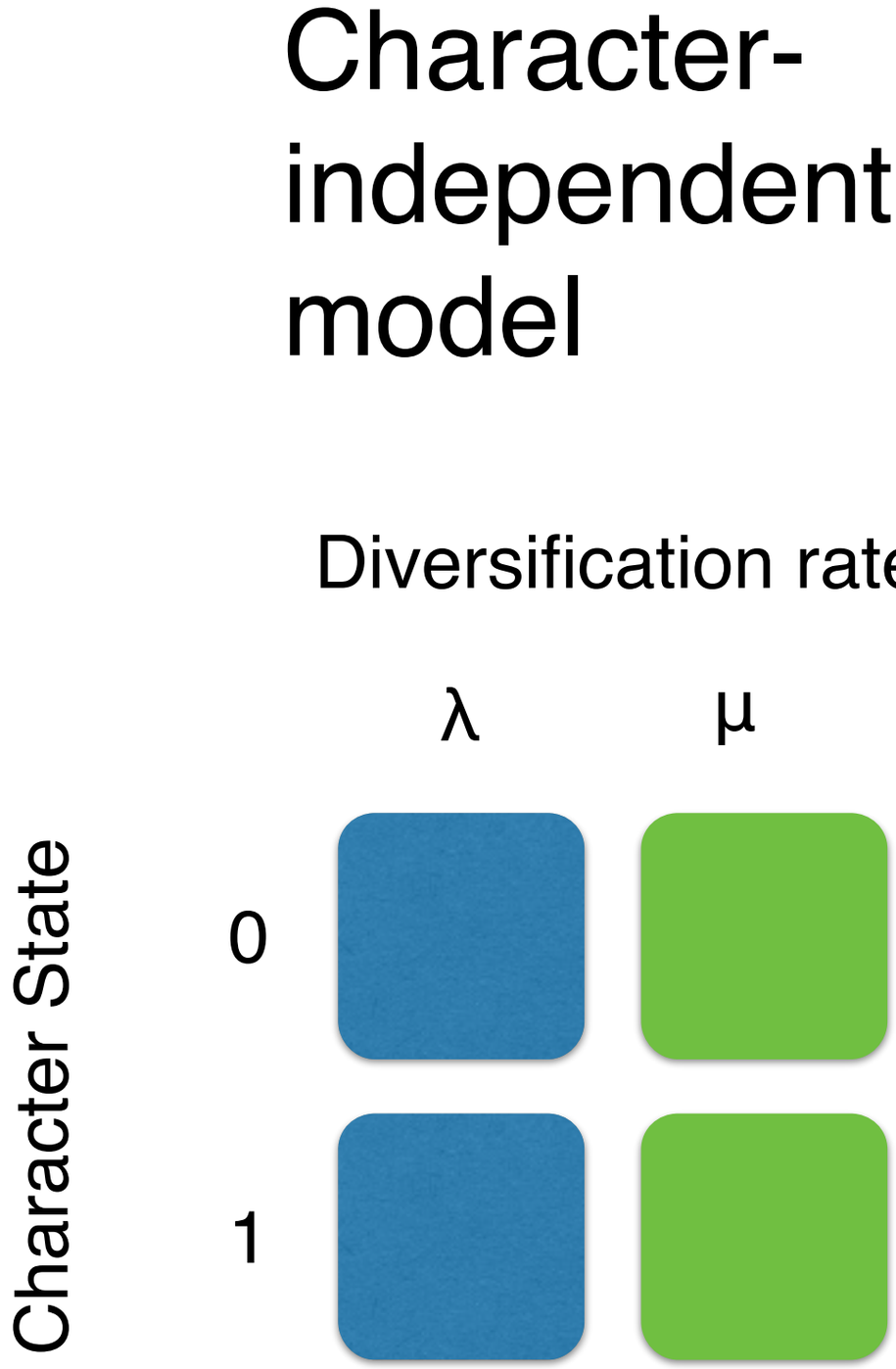
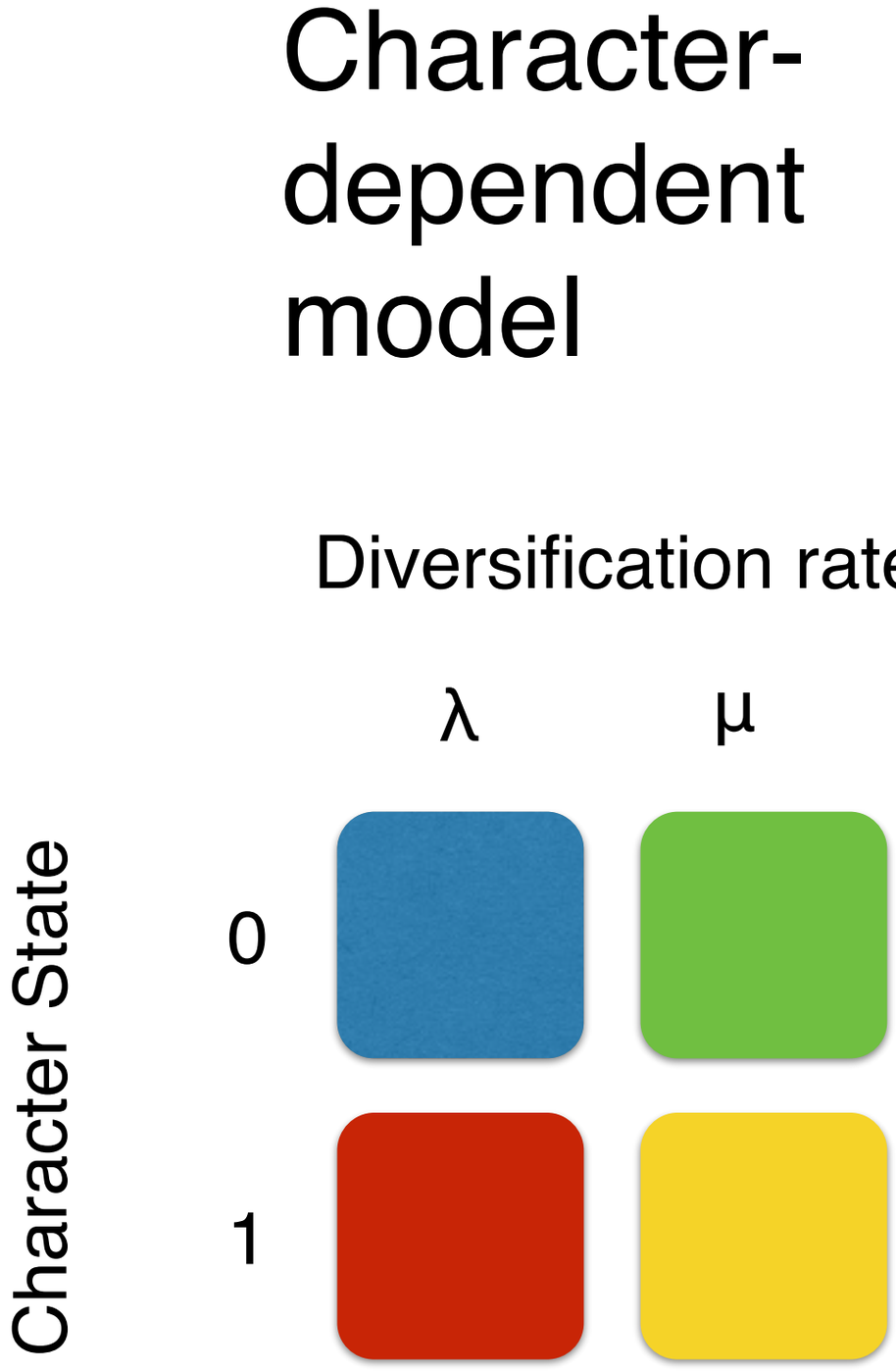
BiSSE and SSE models

Character-independent model

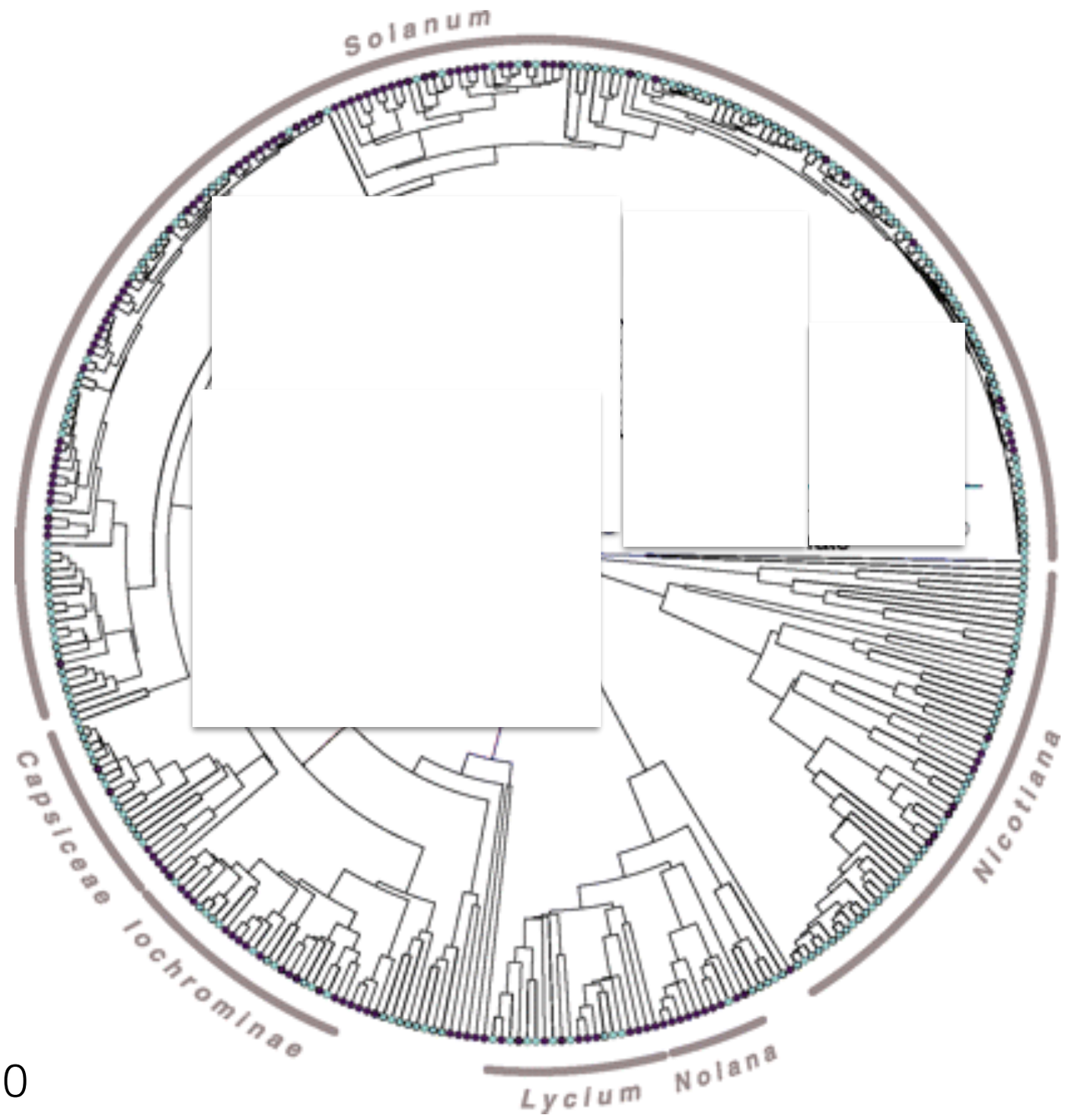
vs.

Character-dependent model



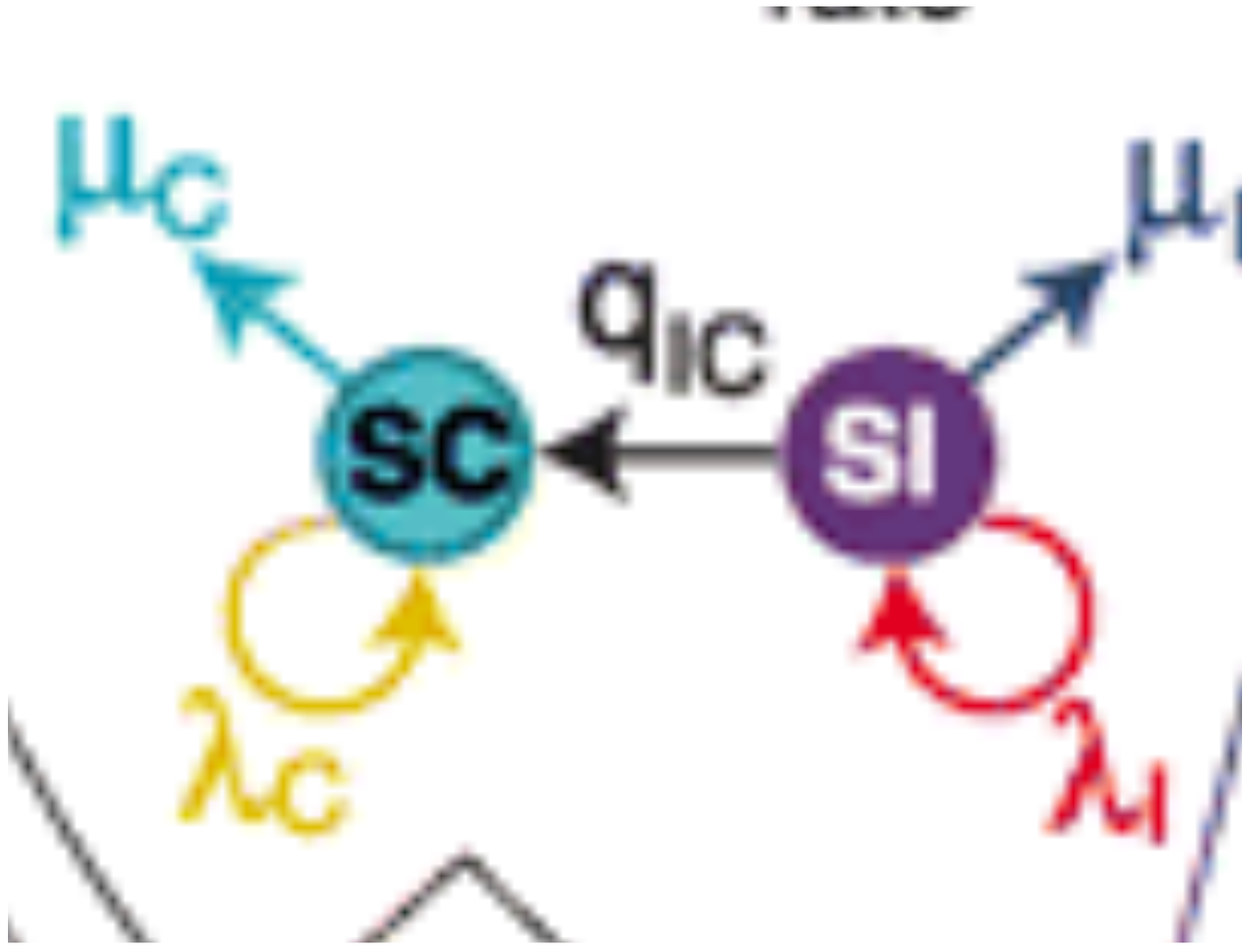


selfing and diversification rate in Solanaceae

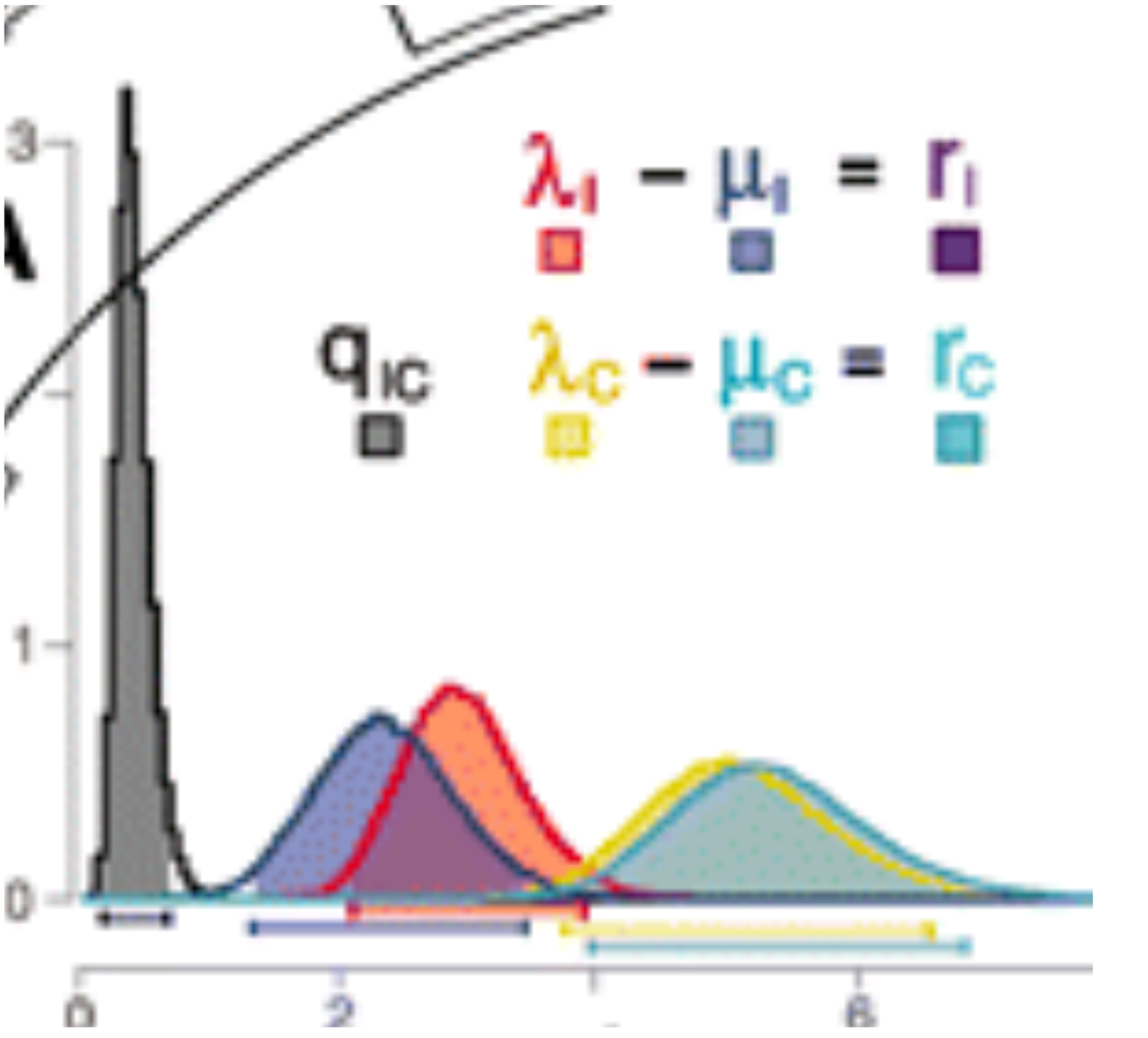


Goldberg et al., 2010

selfing and diversification rate in Solanaceae

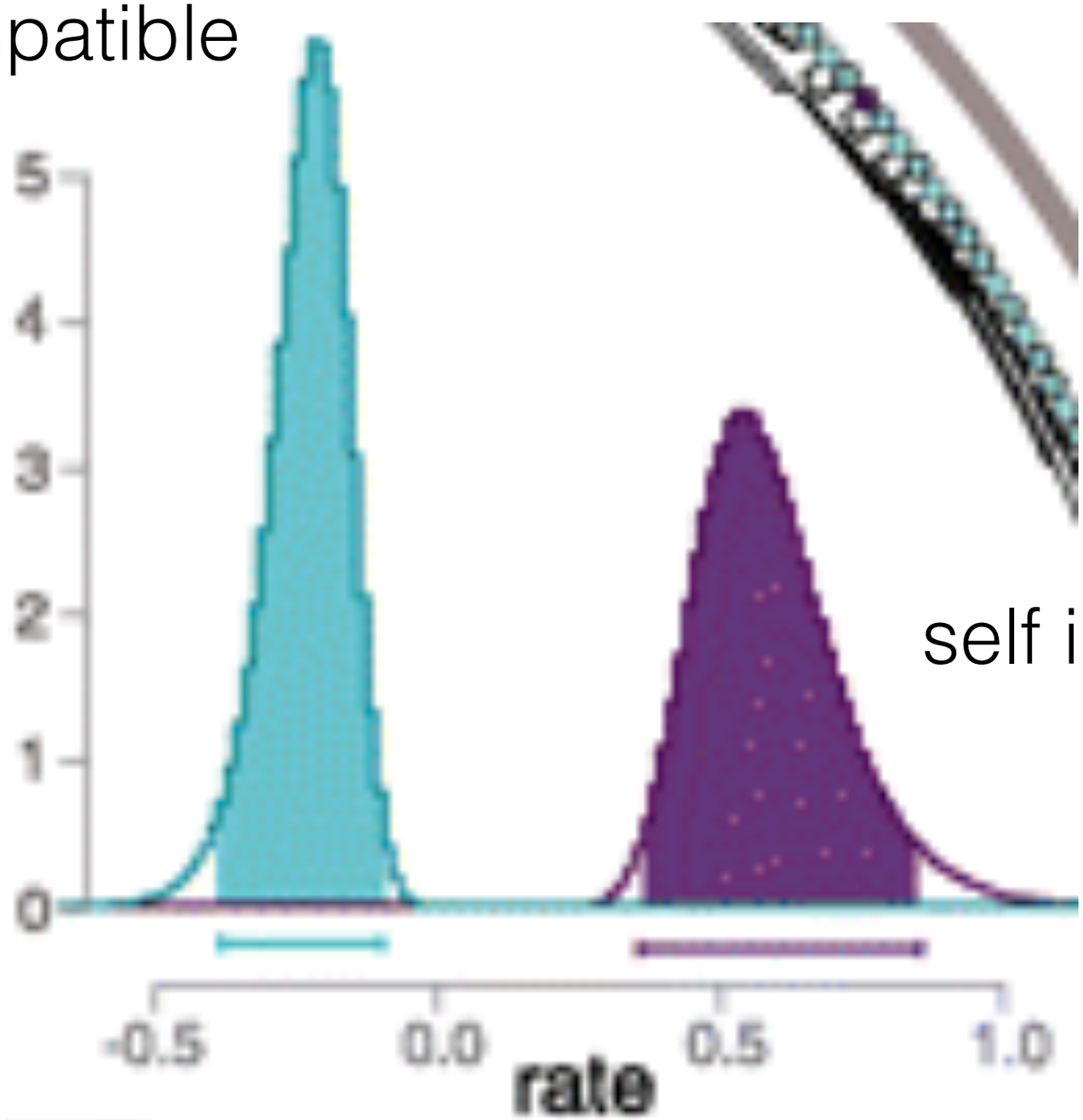


selfing and diversification rate in Solanaceae

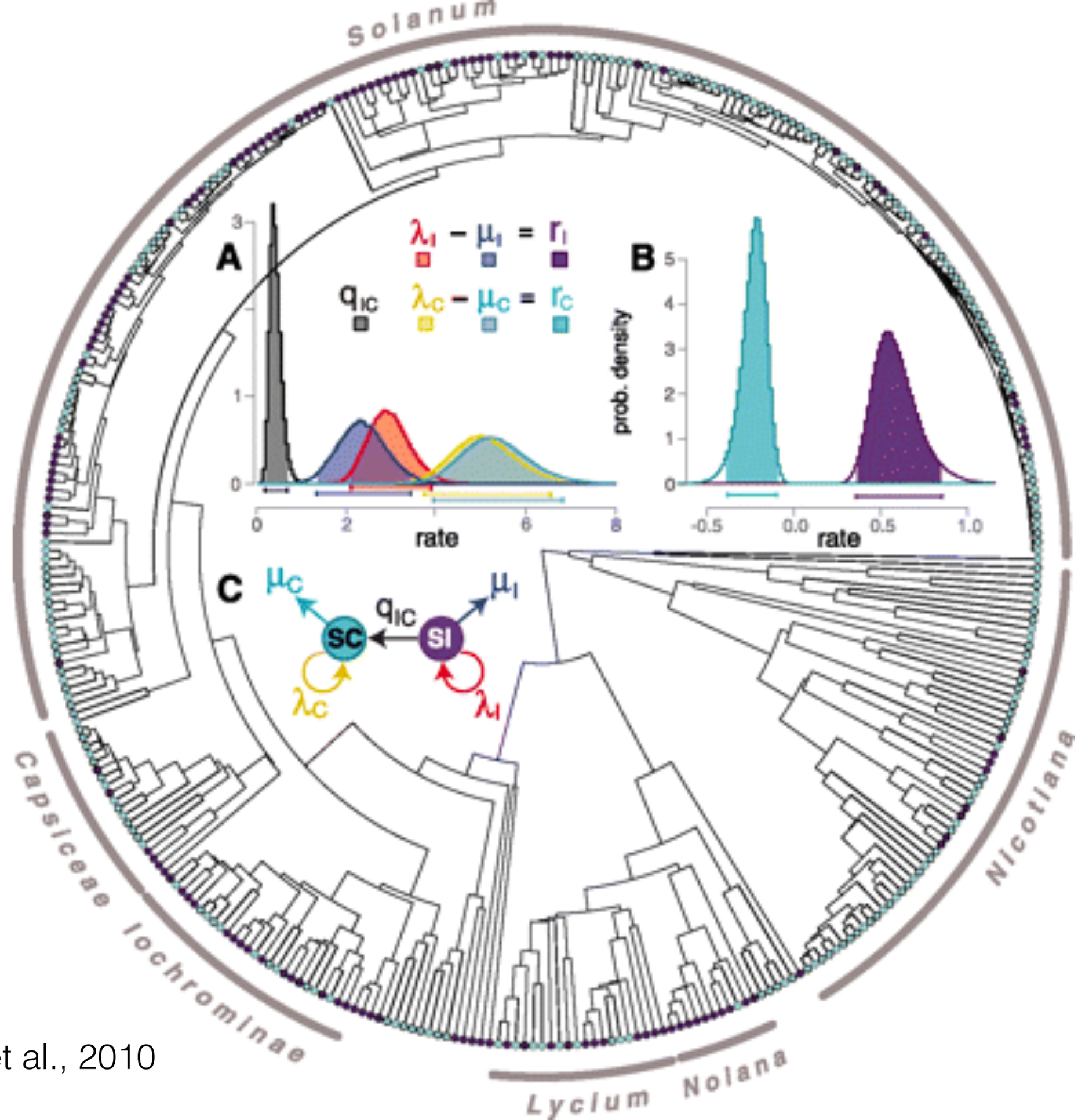


selfing and diversification rate in Solanaceae

self compatible



self incompatible

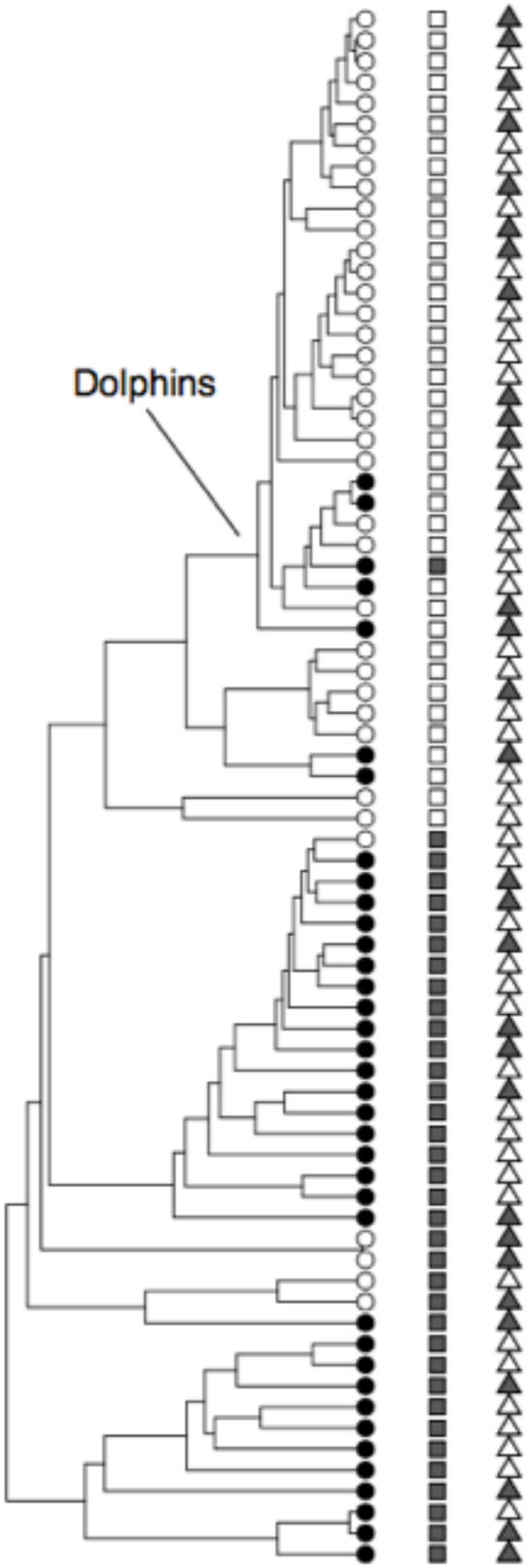


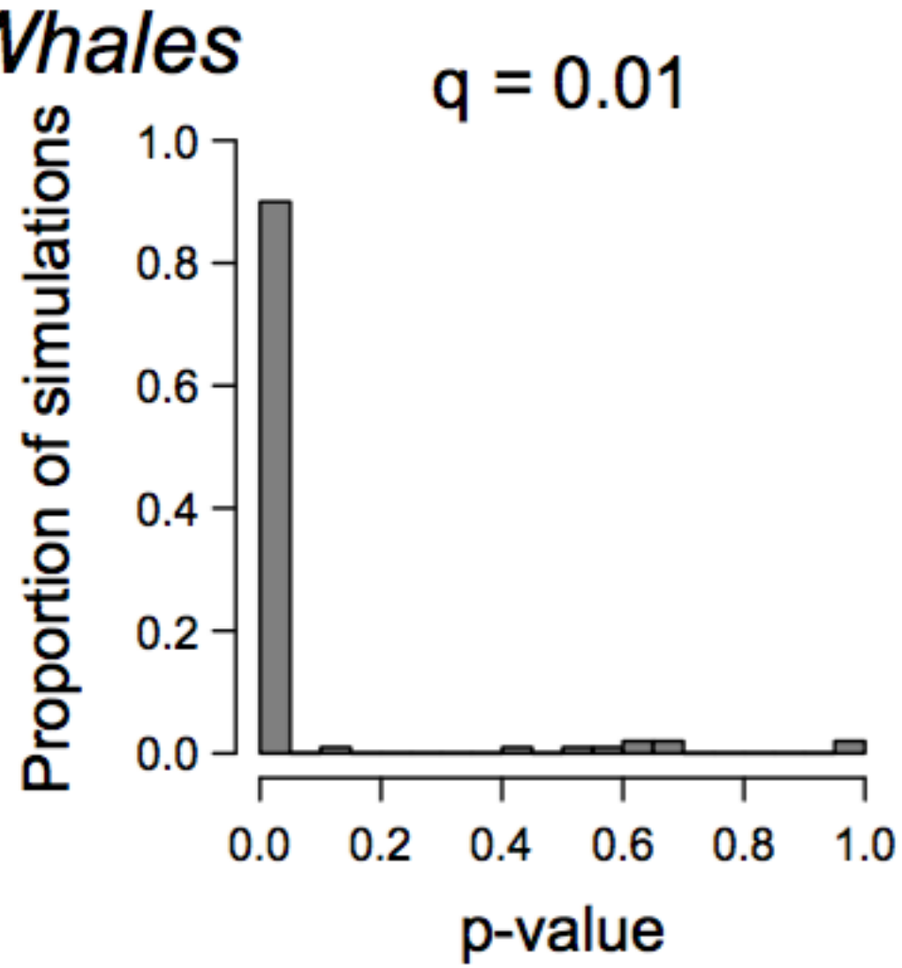
Goldberg et al., 2010

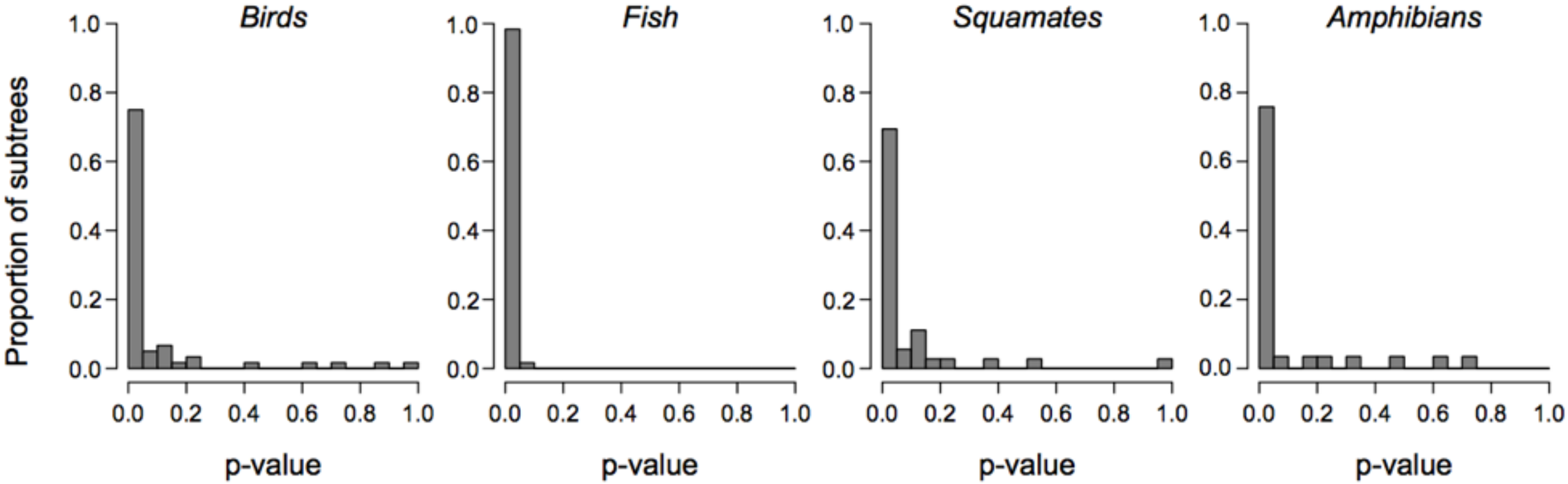
BiSSE Family

- BiSSE - binary character
- MuSSE - multi-state character
- ClaSSE - cladogenesis
- GeoSSE - geography
- QuaSSE - quantitative character

Trouble in paradise






Birds
Fish
Squamates
Amphibians
Proportion of subtrees
p-value
0.0
0.2
0.4
0.6
0.8
1.0

Why is this happening?

- underlying trees show diversification rate heterogeneity
- null model (trait independent diversification on a constant rate tree) does not explain data well
- BiSSE alternative model (traits explain heterogeneity) is a much better explanation for data set

what does it mean?

- this is not Type I error. When model correct, BiSSE shown to have acceptable Type I rates
- the alternative models are *inadequate*
- **rejecting null does not mean alternative is true!**

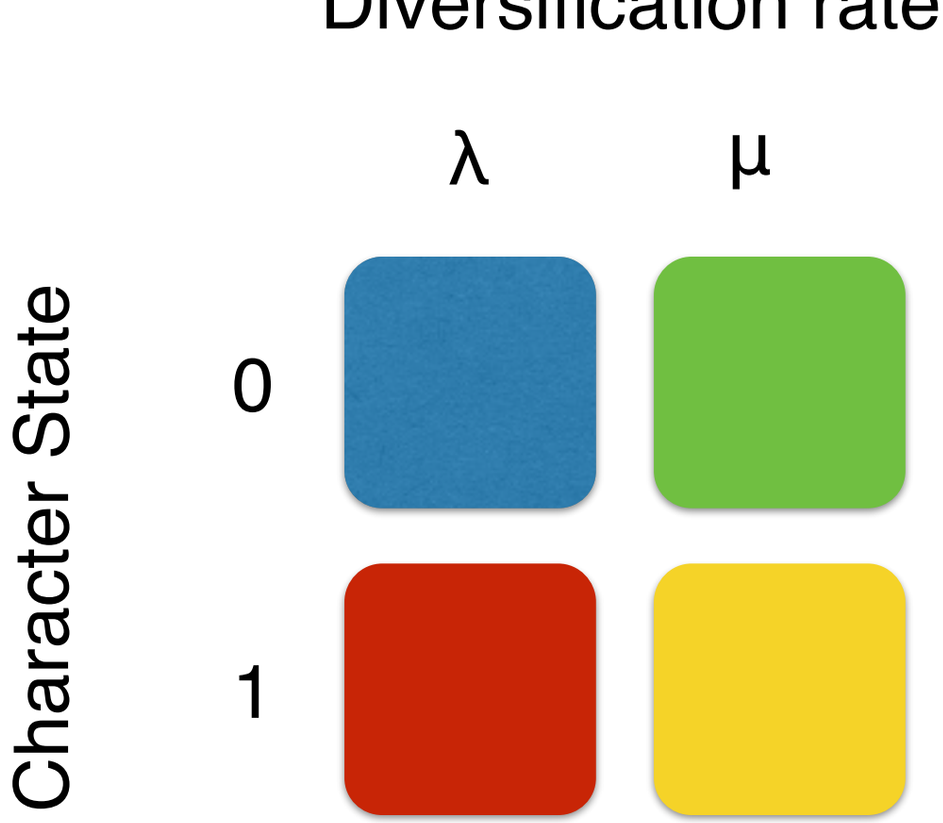
Solutions?

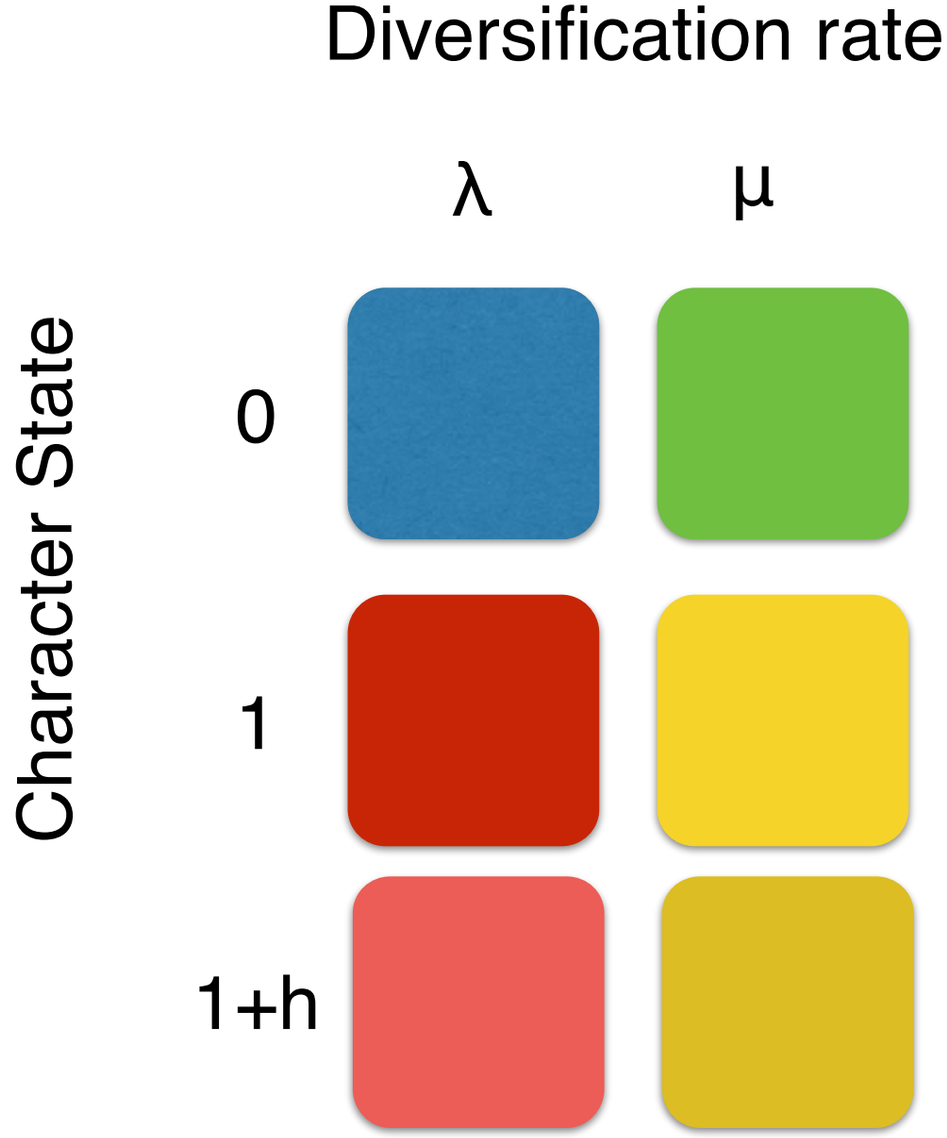
- assess character distributions and diversification rate heterogeneity
  - simulations of traits on underlying tree
- better null models (HiSSE)

Character-dependent model

vs.

Character-dependent hidden state





- HiSSE (hidden state SSE)
  Beaulieu and O'Meara, in review
- HiSSE allows for null models where diversification rate changes on tree independent of character
- hidden state also reveals how much your trait model explains relative to all of the trait-related heterogeneity present on the tree