Contribution of traits, phenology, & phylogenetic history to plant-pollinator network structure

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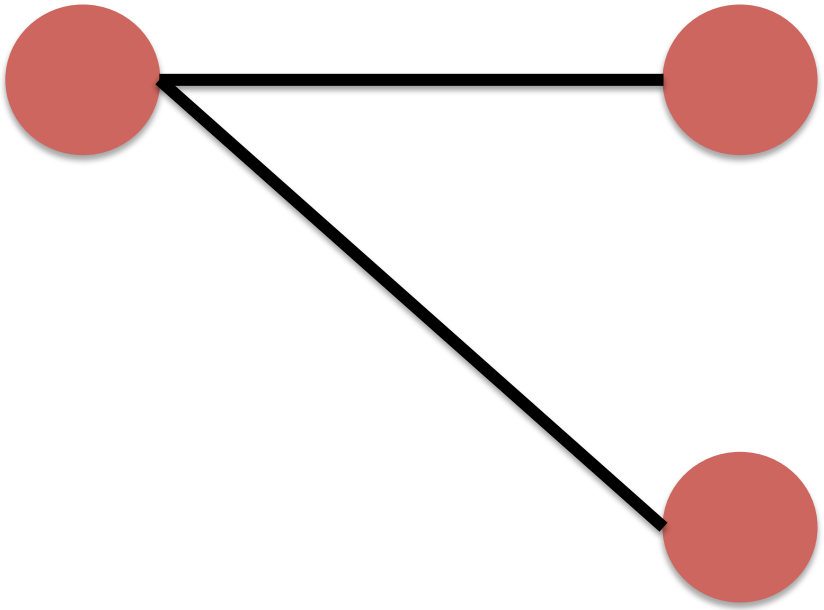
Thanks to!

- Elizabeth Elle
- Jana Vamosi
- Ralph Cartar
- Sarah Semmler
- Anne Worley
- And many more that provided data…

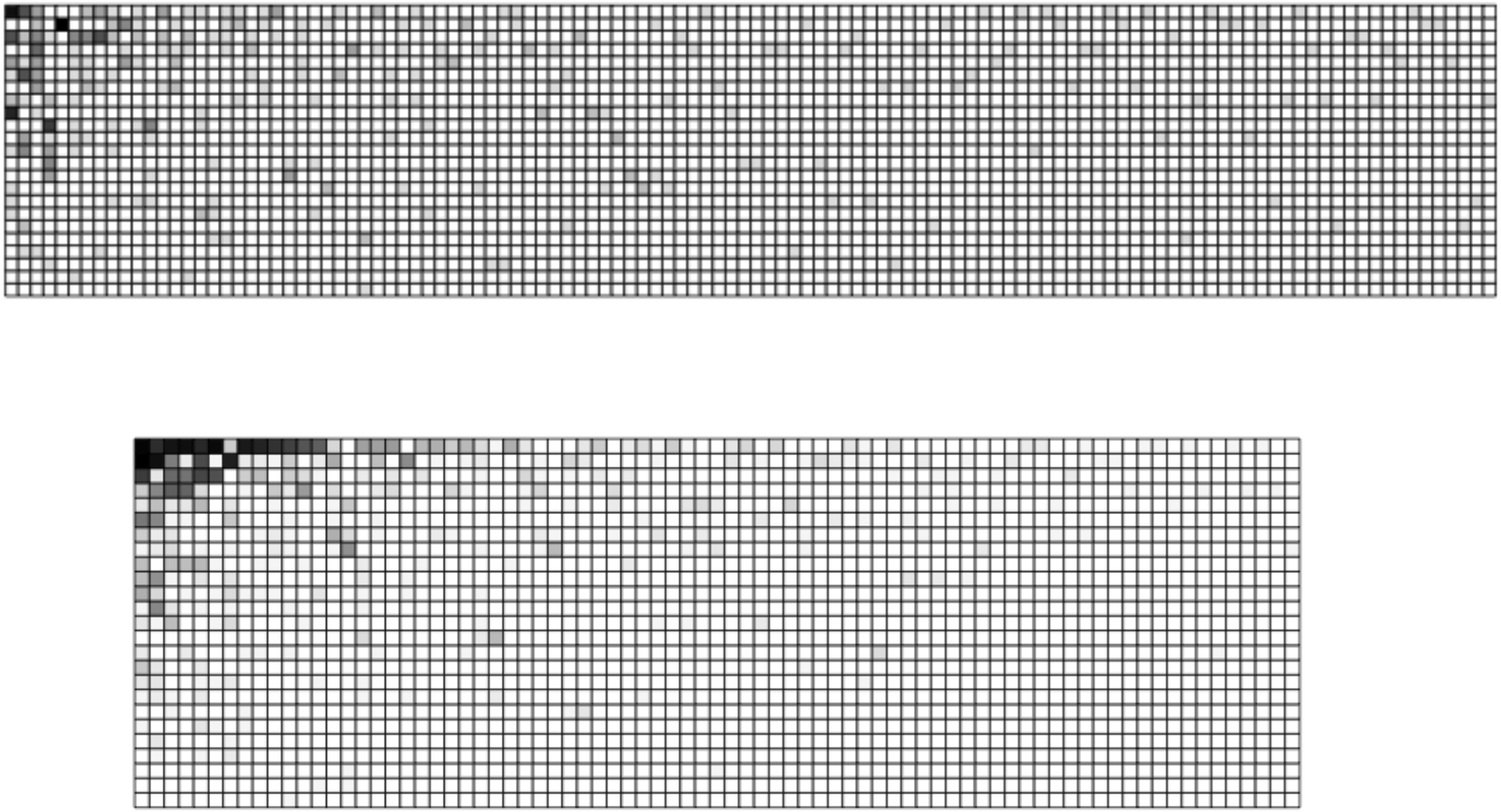
Species in communities form networks



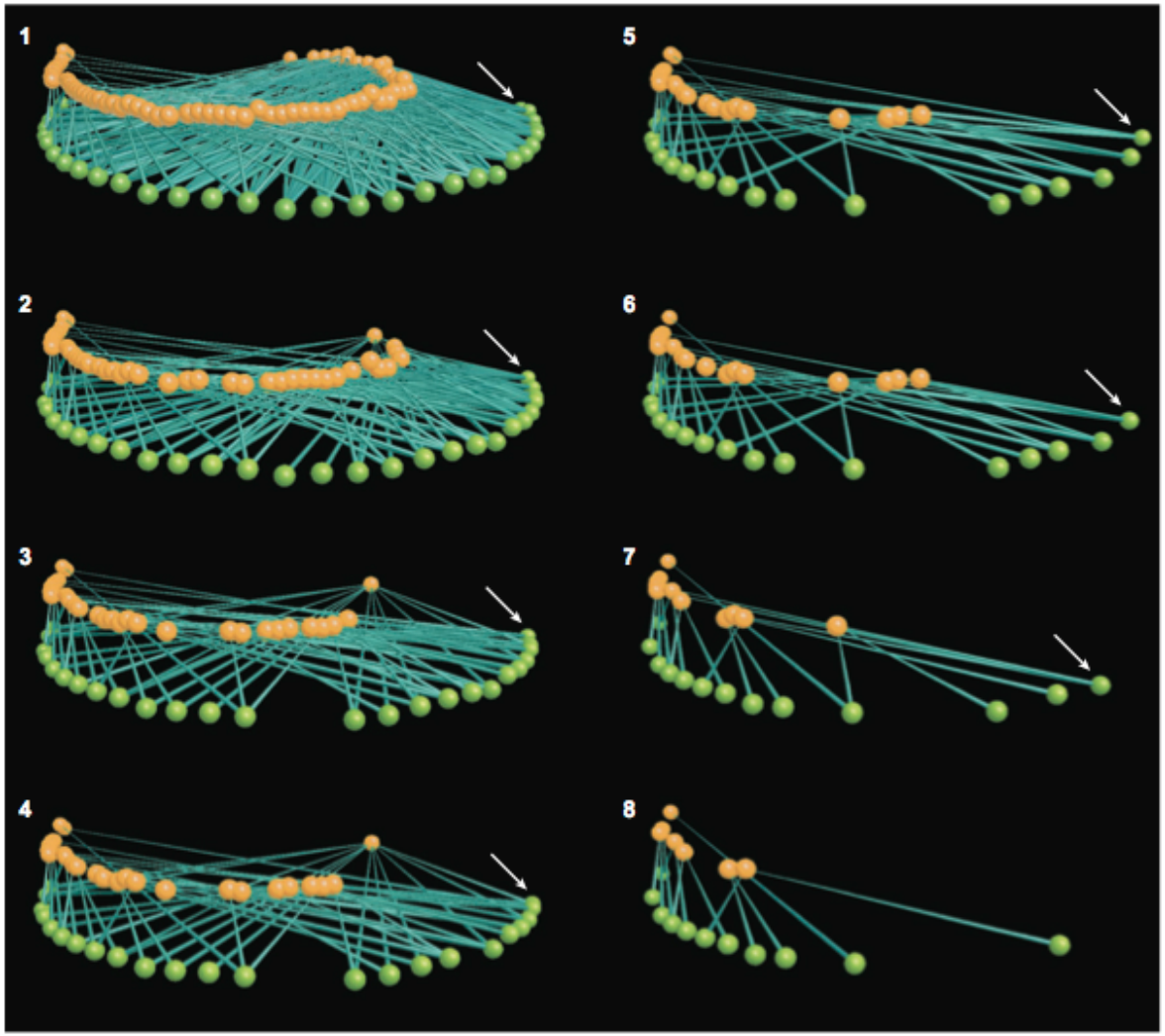
Patterns often similar among networks

Pollinators

Plants



Structure matters



Bascompte&Jordano2007AREES

What drives network structure?

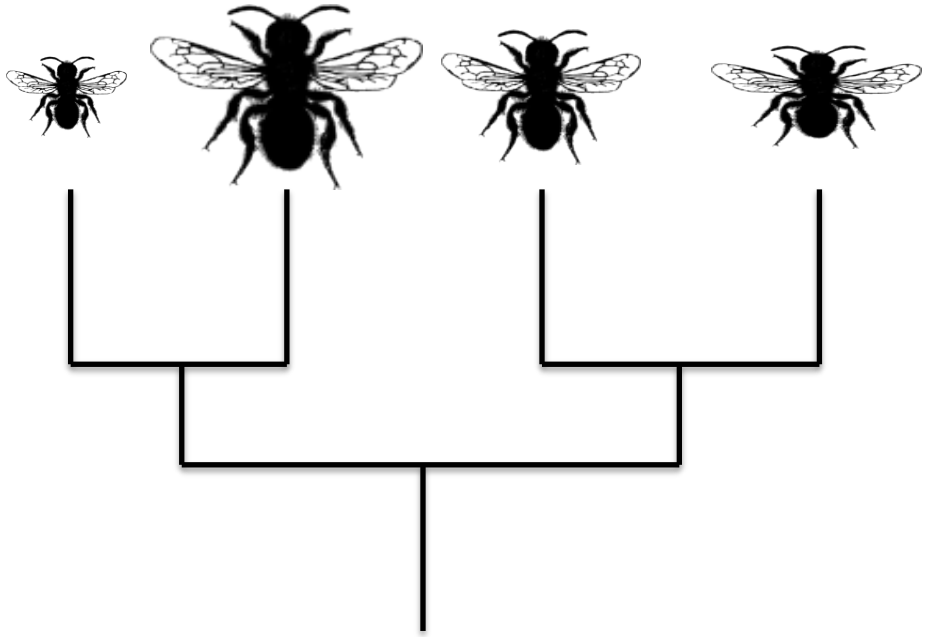
Traits

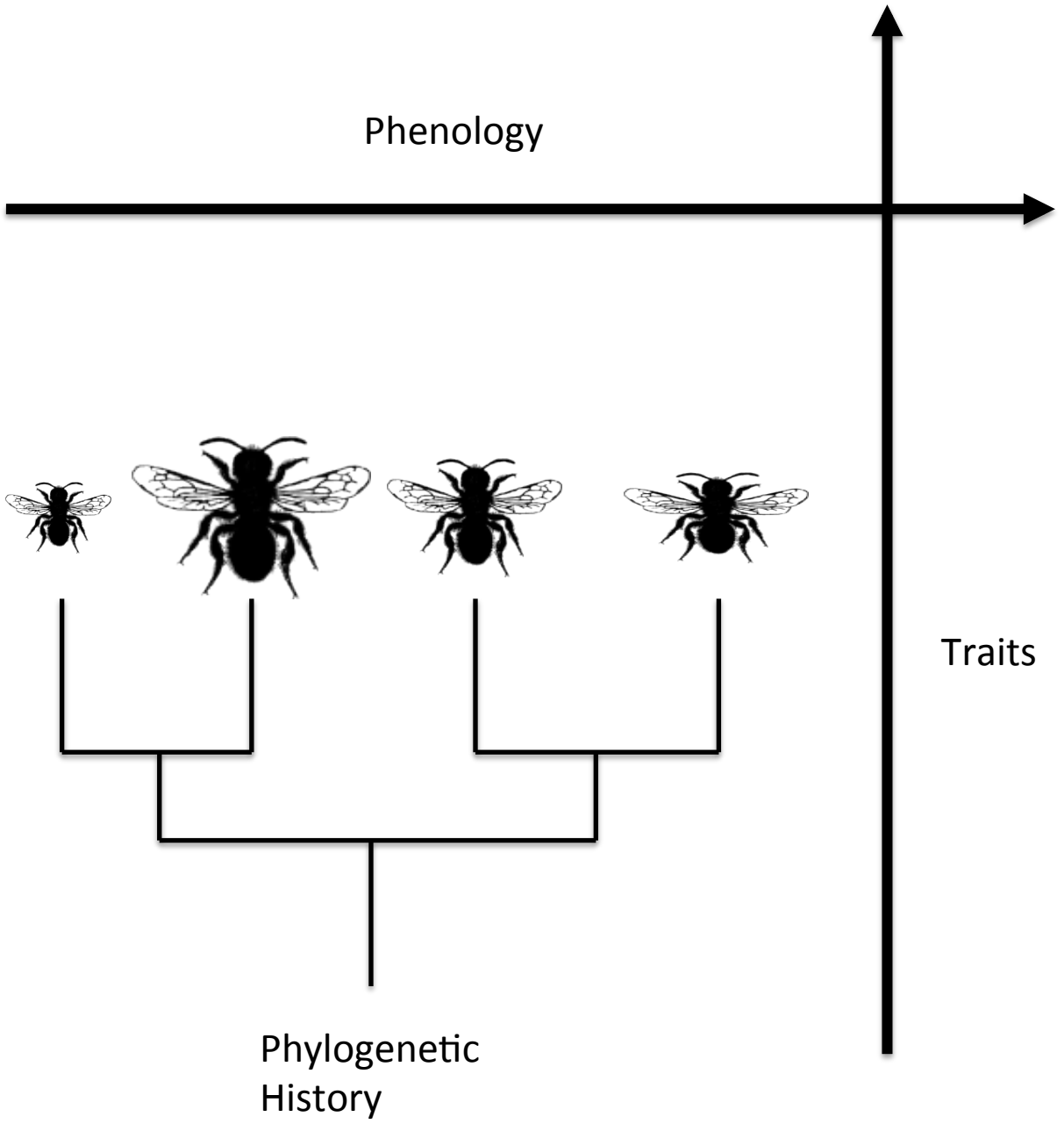
Body size

Phenology

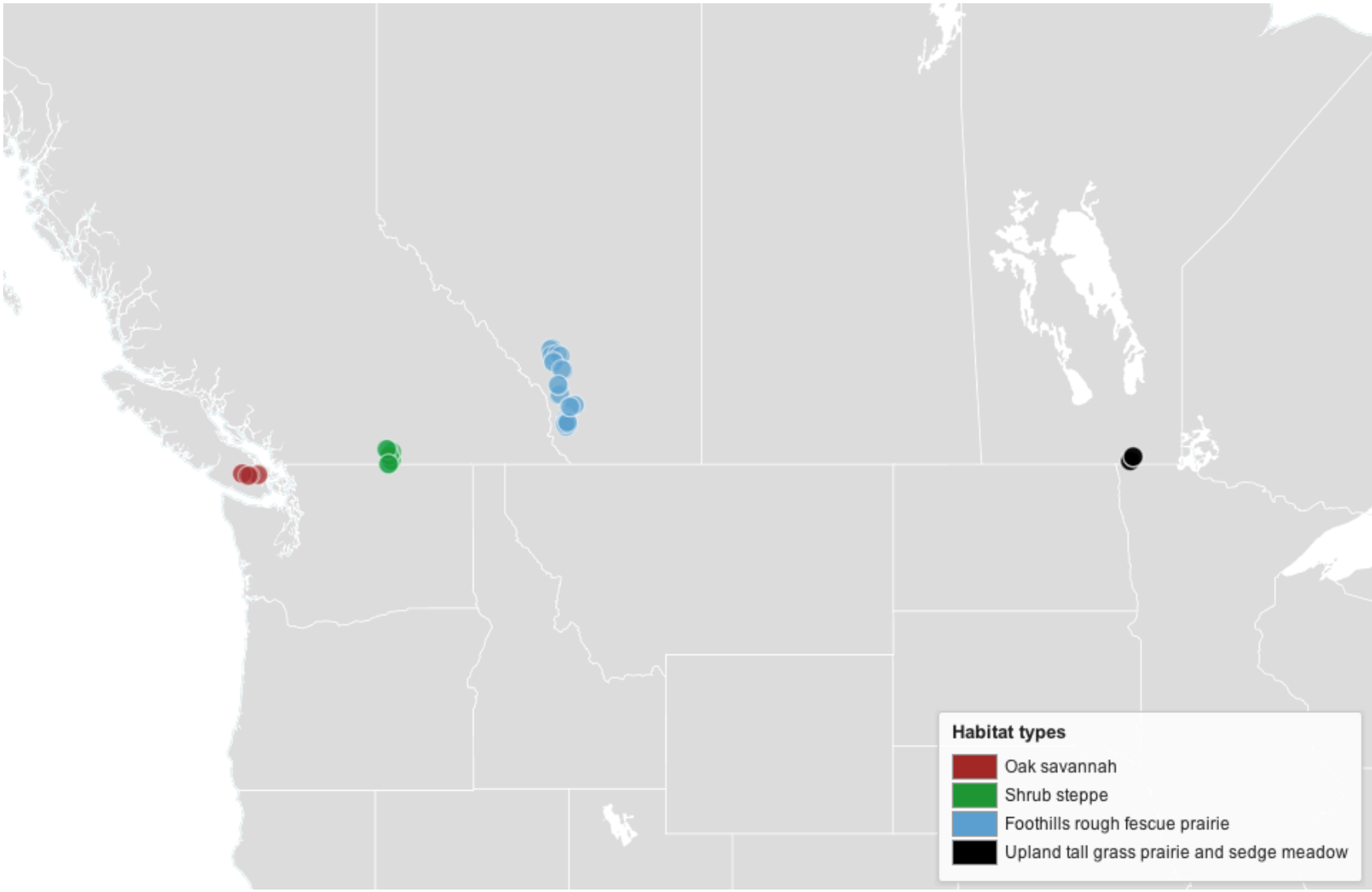
Emergence date
Or
Seasonal activity

Phylogenetic History



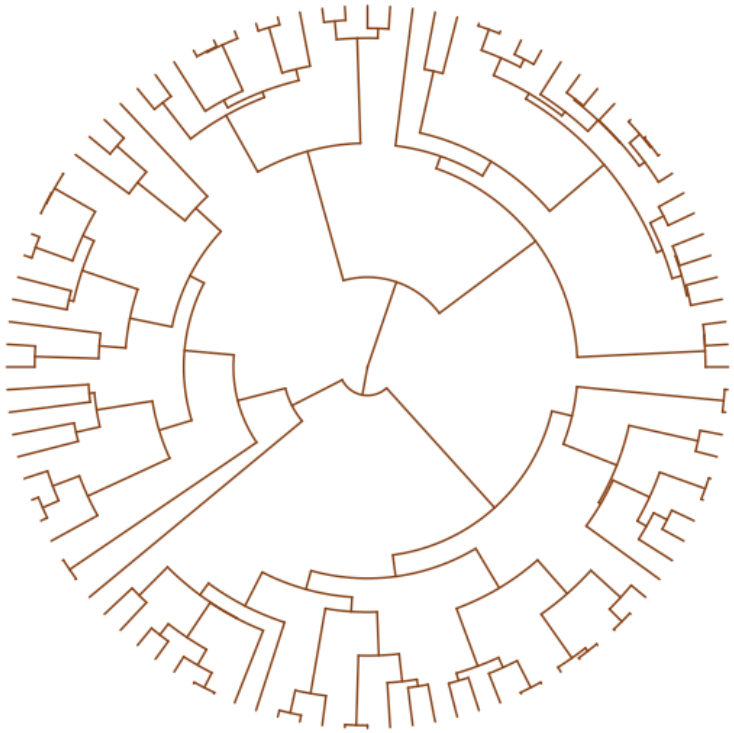

Phenology
Traits
Phylogenetic
History

Study sites

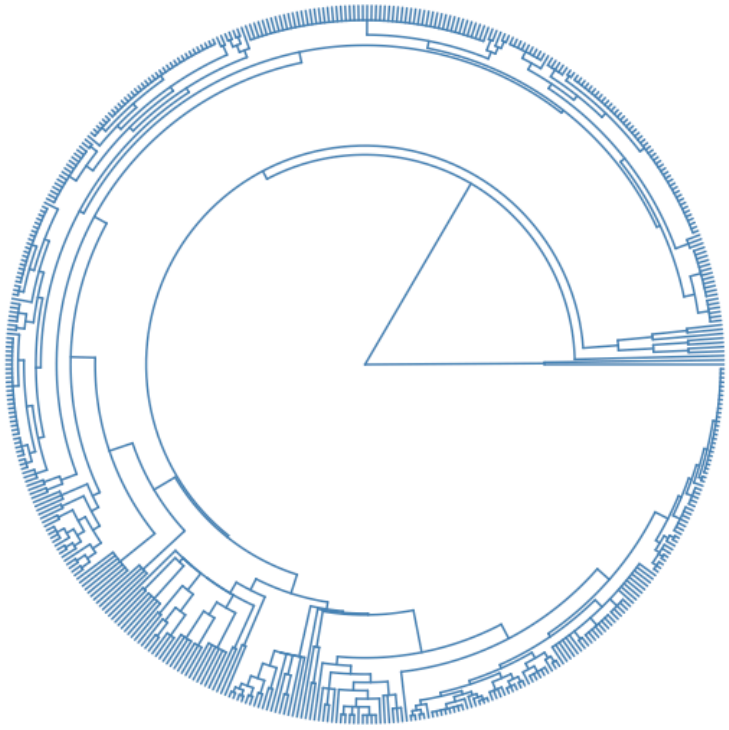

Habitat types
Oak savannah
Shrub steppe
Foothills rough fescue prairie
Upland tall grass prairie and sedge meadow

Phylogeny

Plants

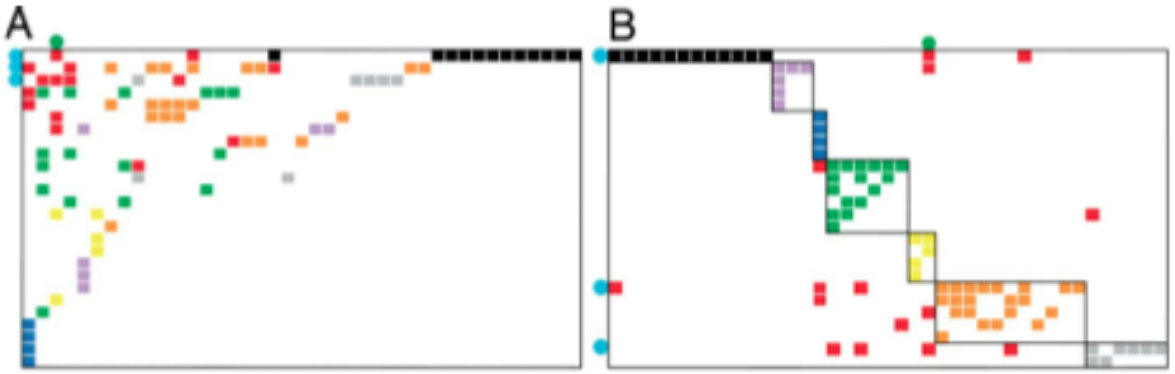


Pollinators



Species level metrics

- Degree
- Specialization (accounts for interaction intensity)
- Within module degree
- Among module connectivity



Traits - Pollinators

- Nest location: above/below ground - **NS**
- Nest type: excavator/renter - **NS**
- Parasitic: yes/no - **NS**

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- Nest type: excavator/renter - **NS**
- Parasitic: yes/no - **NS**
- Social: solitary/social –
  - Within module degree: social (module hubs), solitary (peripherals)
  - Among module connectivity: social (connectors), solitary (peripherals)
  - Degree: social (higher), solitary (lower)
- Body size – larger spp. w/ larger degree

Traits - Plants

- Breeding system
  - Gynomonoecious: less specialized, higher degree
  - Hermaphrodites: more specialized, lower degree

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  - Woody: higher within module degree

Traits - Plants

- Breeding system
  - Gynomonoecious: less specialized, higher degree
  - Hermaphrodites: more specialized, lower degree
- Growth form
  - Herbaceous: lower within module degree
  - Woody: higher within module degree
- Flower symmetry:
  - Bilateral: lower within module degree, lower degree
  - Radial: higher within module degree, higher degree
- Flower size: smaller flowers higher within module degree

Network level

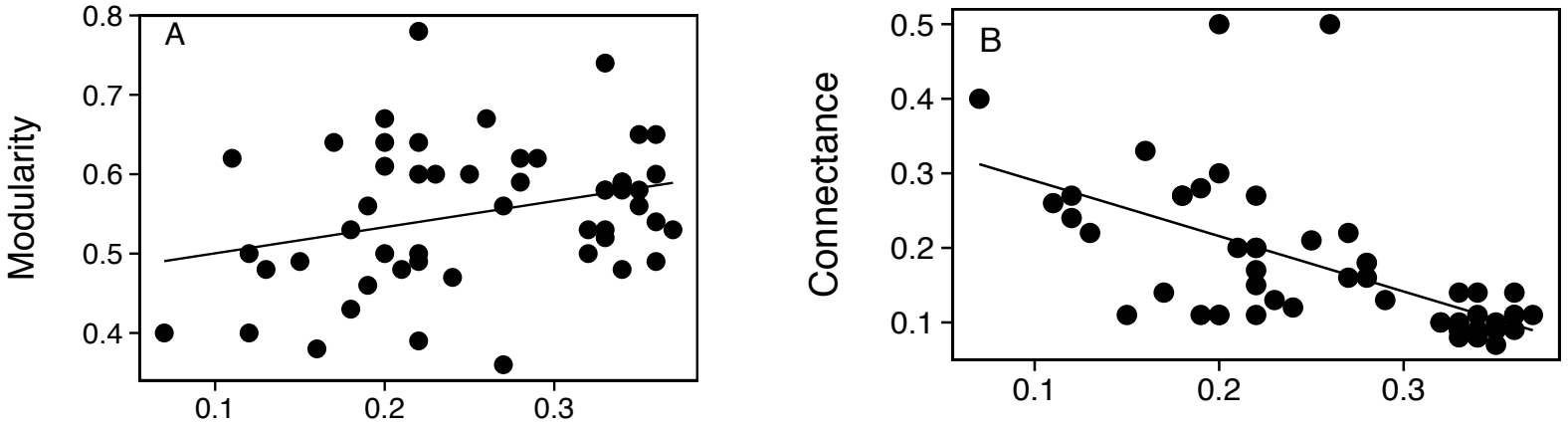
network structure ~

FDisPO + FDisPL + MPDPO + MPDPL

Network level

network structure ~

FDisPO + FDisPL + MPDPO + MPDPL



Conclusion

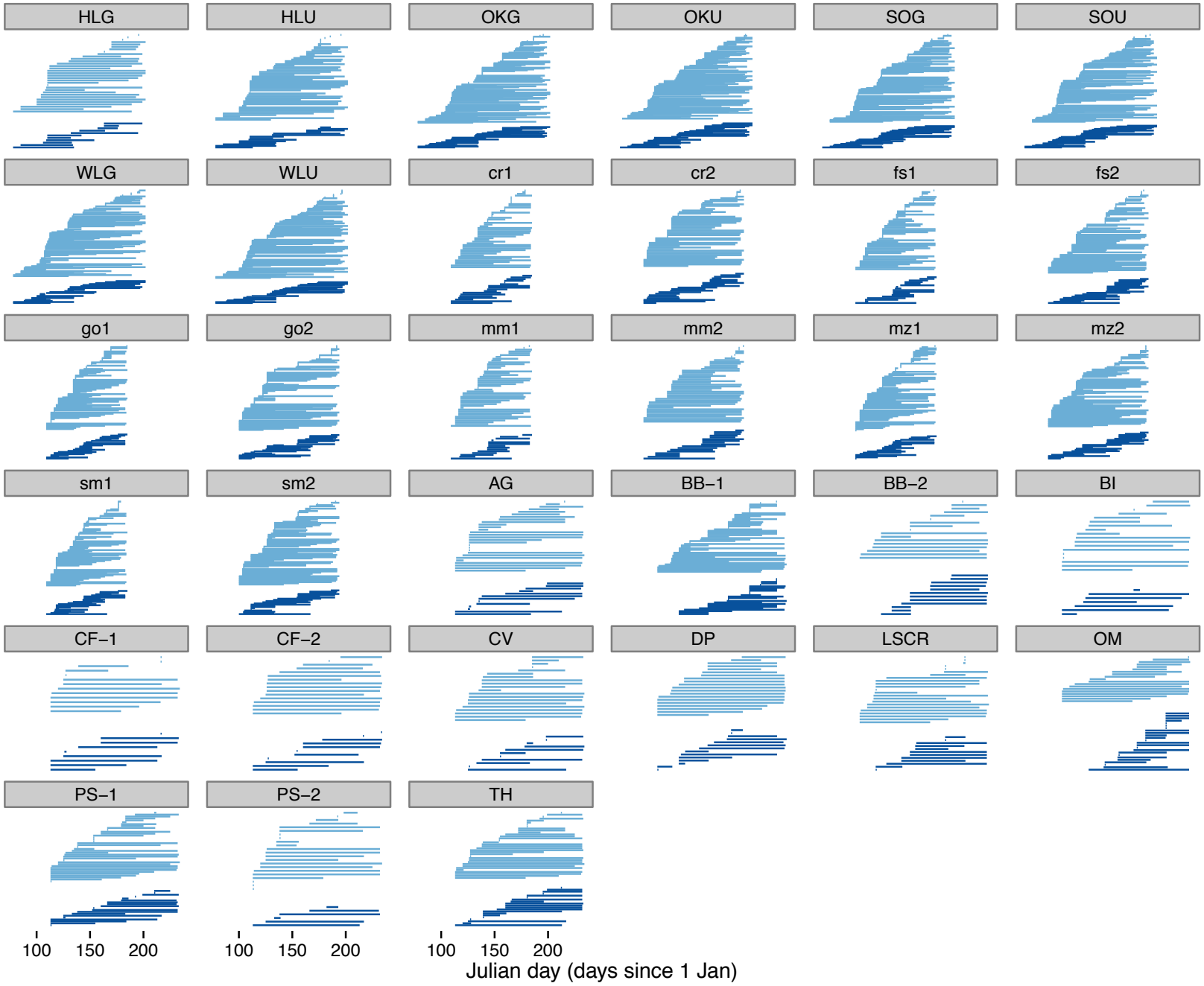
- Species level
  - Sociality important in pollinators
  - Mating systems, flower symmetry & growth form important in plants

- Network level
  - At network level, ↑ pollinator functional diversity w/ ↑ modularity & ↓ connectance
  - Pollinator traits bigger drivers of network structure relative to plants

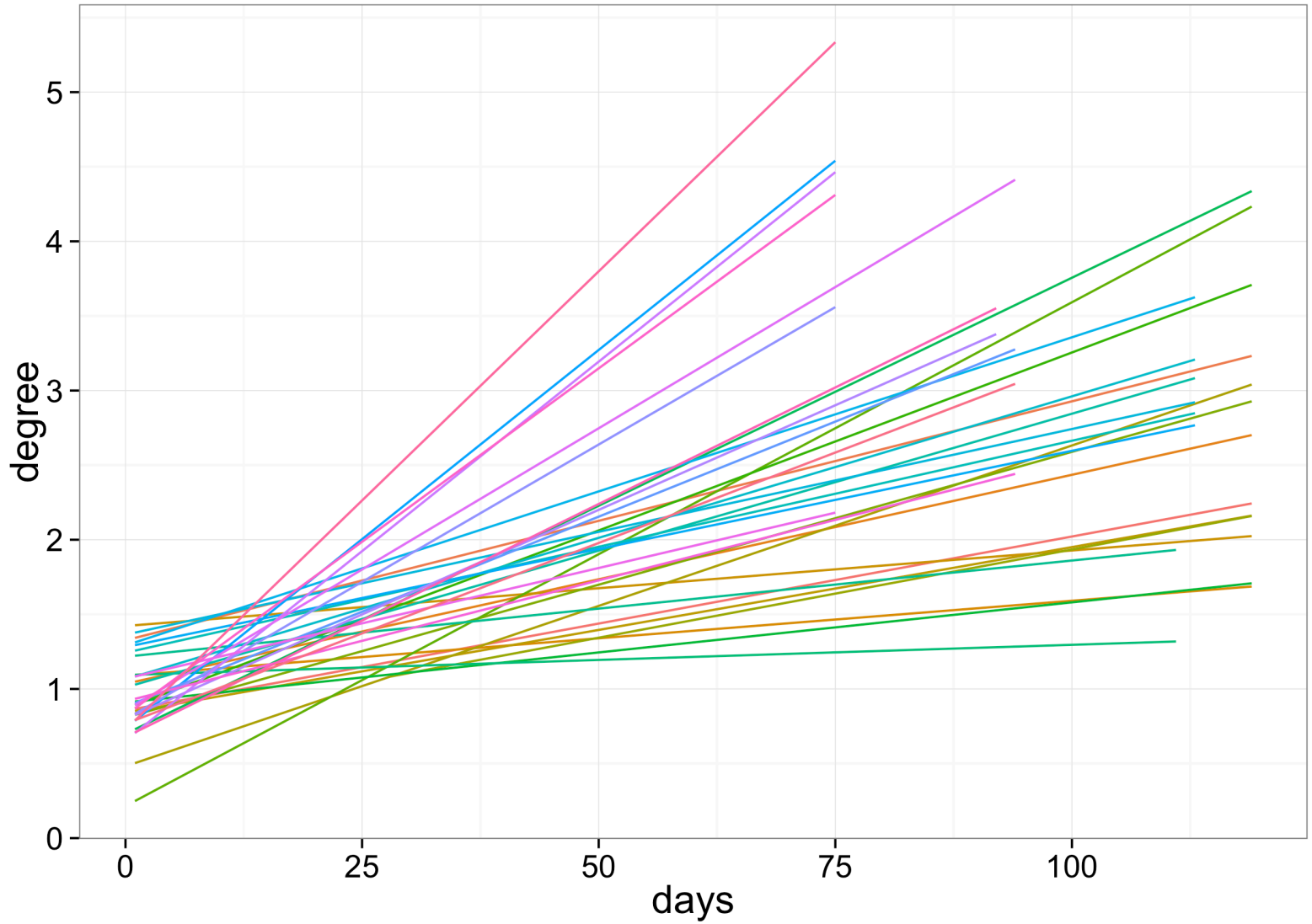
Phenology

- Species vary in when they start flowering (plants) and start flying (pollinators)

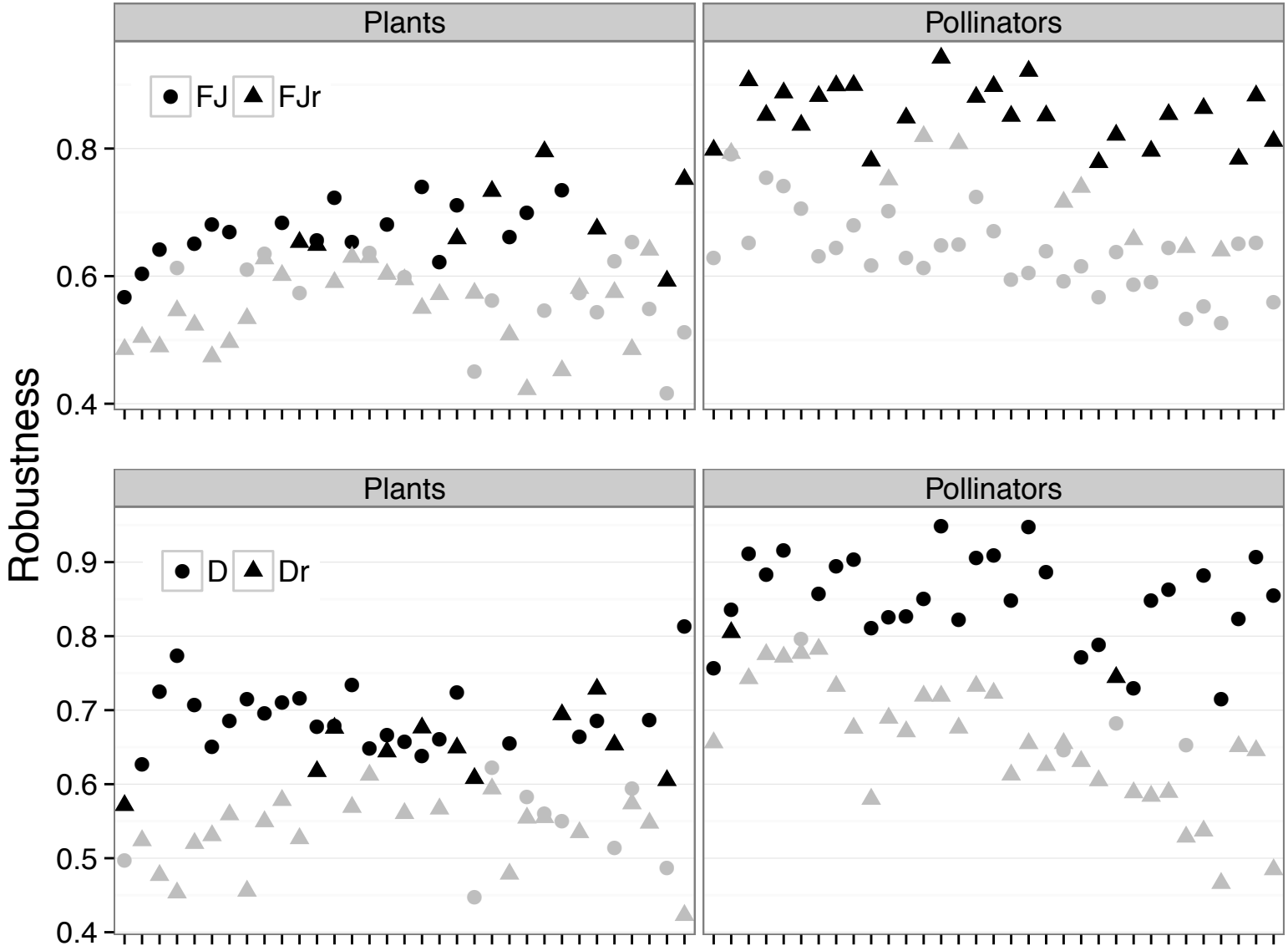
- Variation among species can lead to changes in network structure


HLG
HLU
OKG
OKU
SOG
SOU
WLG
WLU
cr1
cr2
fs1
fs2
go1
go2
mm1
mm2
mz1
mz2
sm1
sm2
AG
BB−1
BB−2
BI
CF−1
CF−2
CV
DP
LSCR
OM
PS−1
PS−2
TH
100
150
200
Julian day (days since 1 Jan)

Phenology is associated with structures



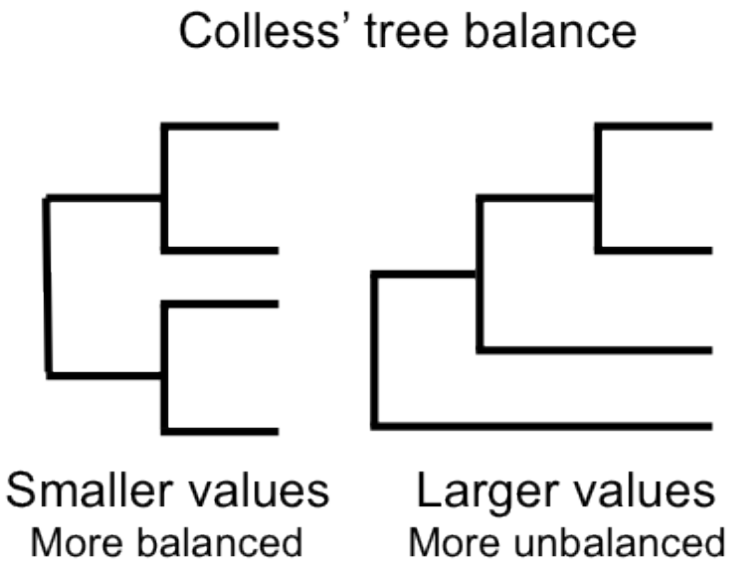
Robustness differs among groups

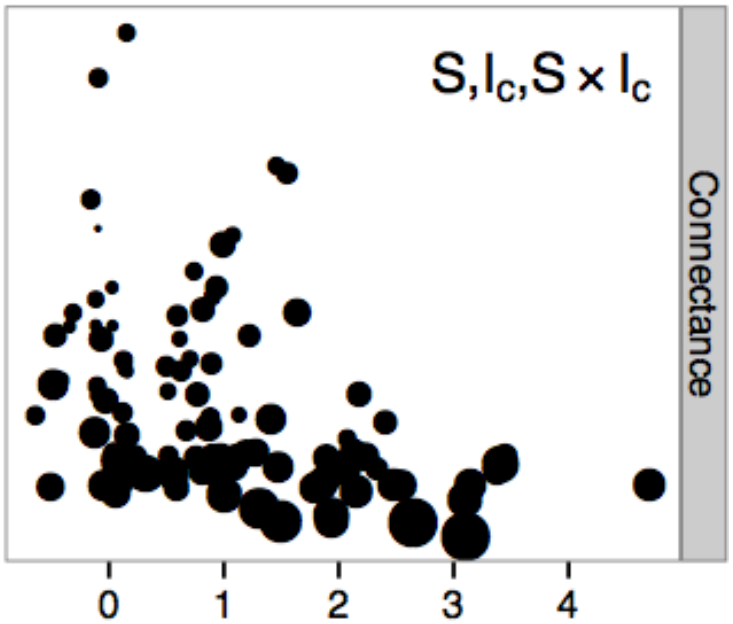


Phylogenetic tree shape

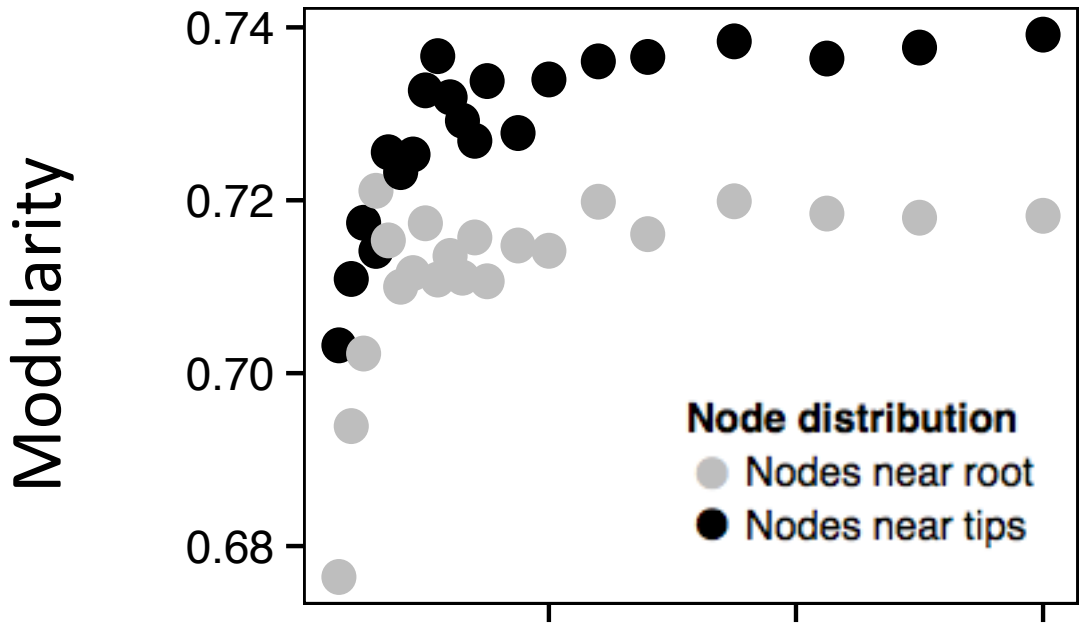
- Shape easily measured
- Metrics represent whether
  - Branching events recent or old
  - Branching events even across tree, or some groups speciate more than others
- Shape could influence who interacts with who

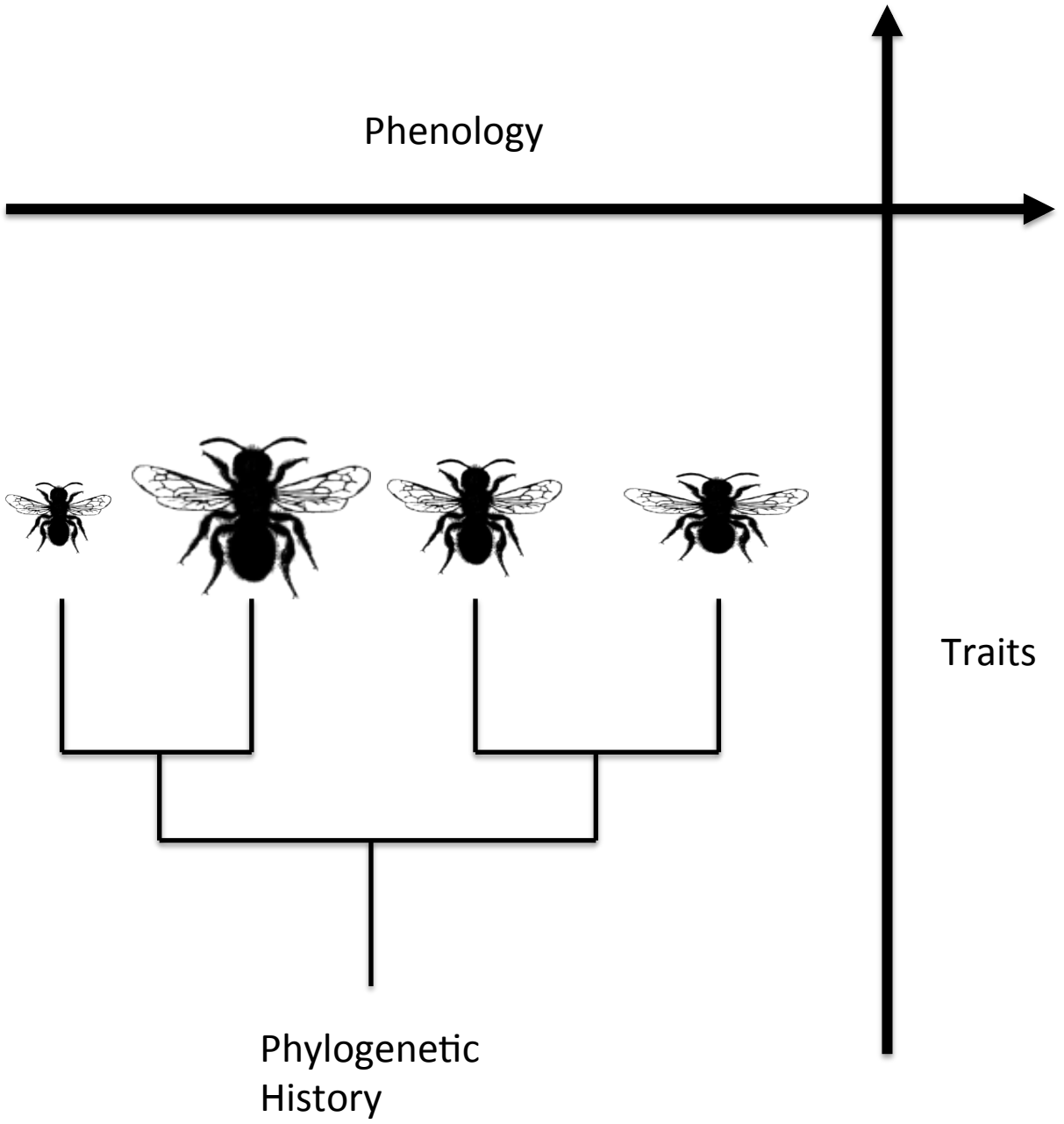
Shape correlated with network structure





Simulations suggest a causal link

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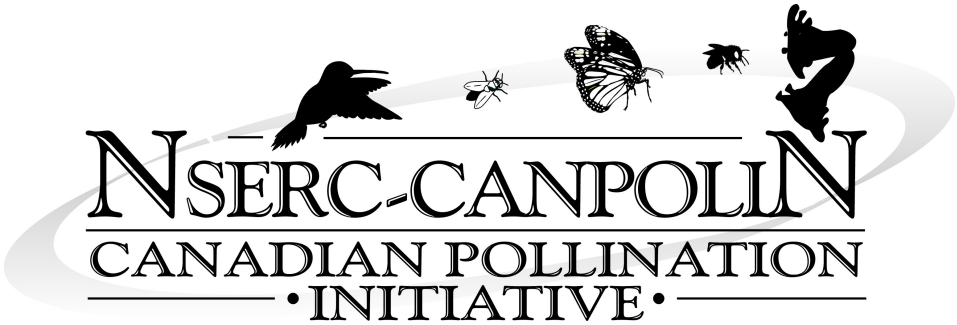

Silhouettes: Phylopic.org
http://phylopic.org/image/070c78bc-e075-4098-a66b-fca2f02680ea/