Lecture 22: Specialization, Coevolution

- Species interactions
- Specialization
- Coevolution:
  - Competitors
  - Predators-prey
  - Cospeciation
- When is it coevolution?

Can species interactions drive the evolution of biological diversity?

Cuckoos: brood parasites
- Lay eggs in nest of other birds
- Nestlings eject host egg/nestling
- Specialists
  - Different races each specialized on different host

Types of species interactions

++ Mutualisms: pollinator-plant, plant-seed disperser
+- Antagonistic interactions:
  Brood parasitism, Predator-prey, Plant-herbivore
-- Competitive

Coevolution in competitive interactions

Reciprocal Selection:
- The fitness of Species 1 individuals is decreased by interacting with Species 2
- And the converse!
- Reciprocal selection favors traits that reduce the interaction

Sticklebacks: Is divergent body morphs due to coevolution?

An experiment: competition and coevolution

- Measured the fitness effect of Paxton Limnetic species on Cranby Lake intermediate species
- w/ limnet species: expect selection toward benthics

An experiment: competition and coevolution

- Paxton Lake: limnetic and benthic
- Cranby Lake: 1 intermediate species
**Predator-Prey coevolution: garter snakes and newts**

- Brodie and Brodie, et al.
- Rough-skinned newt: TTX tetradotoxin in skin
  - Paralytic
- Snake *T. spiralis*
  - Amphibian specialist
  - Resistance: overcome paralytic effects

**Red Crossbills: predator-prey coevolution**

- Specialists: seeds from conifer trees
- Different “species” feed on different trees: pine, spruce, fir, hemlock

**Red Crossbills: predator-prey coevolution**

- Use bill to extract seeds
- “species” differ in bill size
- Is this specialization due to coevolution?

- Compare bill depth with feeding efficiency in a lab study
- Compare bill depth with survivorship in nature
- E.g. Lodgepole pine

- Snake resistance varies
- Have these predators evolved in response to prey?

- For 4 conifer species
- Disruptive selection on bill depth, groove

- Snakes vary in resistance
  - Snake population w/o newts: Susceptible to TTX

- Abilities matched in areas of sympatry

- Compare bill depth with feeding efficiency in a lab study
- Compare bill depth with survivorship in nature
  - E.g. Lodgepole pine

- Abilities matched in areas of sympatry
  - Susceptible to TTX
Reciprocal adaptation?
Crossbills and lodgepole pine
Cones evolve in response to crossbills, squirrels
Crossbill adaptation differ in presence and absence of squirrels

Does coevolution promote biodiversity?
Bacteria Buchnera endosymbiotic with aphids
Bacteria supply nutrients to aphid (mutualism)
Vertical bacteria transfer: mother to offspring via eggs
Strong cospeciation pattern

Is it coevolution?
Trait matching: e.g. plant-pollinator mutualism

Common misconception #2: parasite adaptation to host defenses
Evolutionary tracking is an equally plausible explanation!

Plant evolved phototoxic compounds at some point in time
Moth evolved UV shielding web making behavior at some point in time
Is this coevolution?

When is it coevolution?
Common misconception #2: parasite adaptation to host defenses

Is it coevolution?
Trait matching: e.g. plant-pollinator mutualism

Fig 14.14