Bio1B Evolution 9

Last lecture:
Evolution of sacrifice (altruism)
Species & speciation
• What is a species anyway? (Pp. 487-492)
  – Concepts - typological, biological, phylogenetic
  – Reproductive isolation - mechanisms
  – Easy one? - Humans & living relatives

Today
Species & speciation
• What is a species anyway? (Pp. 487-492)
  – Interesting one - Ensatina salamanders
• Speciation processes (Pp 492-504; Losos & Rickleffs (2009) paper -
  • Introduction & geographic modes
  • Adaptive radiations
• Hybridization - hybrid zones, reinforcement & hybrid-speciation

Geographic modes of speciation

Allopatric sister species among northern, montane Cophixalus (Hoskin 2004)

Ensativa eschscholtzii - One ring species? Or 2 biological species? Or >11 Phylogenetic species
Parapatric evolution of reproductive isolation over a very short distance in the grass species *Anthoxanthum odoratum*.

Peripatric speciation: paradise-kingfishers in New Guinea (Mayr)

Processes: Founder event, drift, selection?

Sympatric speciation on remote islands:
e.g. Lord Howe Island palms (*Howea*) Savolainen et al. 2006 Nature 441:210-214

Recently (<1Mya) formed sister species - ecologically distinct and with divergent flowering time - despite high gene flow across the range of each species on the island.

Adaptive radiations (pp. 524-5)

- Rapid speciation with ecologically-driven divergent selection
- Common on remote islands or other novel environments following colonization
- Promoted by isolation & ecological opportunity

Other examples: African cichlids, Hawaiian arthropods, Andean lupines, Caribbean anole lizards etc etc

e.g. Hawaiian silverswords (Fig. 25.18)
Speciation on islands: Losos & Rickleffs 2009

Adaptive divergence of bill dimensions

Hybrid zones - alternative outcomes

Hybrid zone - Bombina variegata-bombina (Fig. 24.13)

A stable hybrid zone in Ensatina

Hybrid zone - Bombina variegata-bombina (Fig. 24.13)

A stable hybrid zone in Ensatina

Alexandrino et al. 2005

20 yrs later
Recent (<8kya) expansion from long-isolated (>2 Myr) refugia in the NE Australian rainforest

**Hybrid speciation**

- Formation of unique and isolated lineages from inter-lineage hybrids
  - Allopolyploidy (see p. 496)
  - If same ploidy, requires ecogeographic isolation from parent lineages
  - E.g. arid-adapted Helianthus anomalus = H.annuus X H. petiolaris

Fig 24.18, p. 503

**Is there evidence for reproductive isolation?**

**Is there evidence for reinforcement => prezygotic isolation?**

- Skink = narrow (<1km) hybrid zone - random mating, but some selection against hybrids
- Small marsupial - random mating, hybrid swarm
- Frog - reinforcement => Reproductive isolation

Rapid allopatic speciation via reinforcement in the green-eyed tree frog (Hoskin et al. 2005, Nature)

Adaptive shifts via hybridization: diploid vs polyploid


Moritz et al. 2009 PRSL