Zoophilous Pollination

Plant Cost-Benefits

- Animal vs. wind vectors
  - Animals actively seek specific flowers
  - Animals carry pollen farther
- Outcrossing possible at lower popn densities
- Low wind habitats suitable for plant reproduction
- Decreased pollen : ovule ratio

Plant Cost-Benefits

- Production of attractants
- Production of rewards
- Non-pollinating floral visitors
**Animal Cost-Benefits**

- High quality food from reliable sources
- Costs:
  - Pollen load negligible
  - Pollinia may obscure vision or movement
  - Ambush predation

---

**Origins**

![Origins Diagram](image)

Fig. 6.1

---

**Mutualism as Leap-frog Selection**

- Pattern clear for insects
- Not so clear for plants
  - Angiosperm are massively diverse
  - Zamiaceae cycads not more diverse than sister group
  - Gnetales less species rich than Pinaceae

![Mutualism Diagram](image)

Fig. 2.2
Role of Pollinators I

- Pollinator potential: ability of pollinator to remove/deposit pollen

Role of Pollinators II

- Pollinator effectiveness: ability of individual pollinators to transfer pollen
Role of Pollinators III

- Pollinator importance: the net movement of pollen within a plant population effected by a pollinator group during a flowering season

Pollination Syndromes

- Balance of trade-off between pollinator attraction/reward and optimizing out-crossing
- Indiscriminate attraction not ideal
- Selection to reduce self-fertilization

Out-crossing Mechanisms

- Protandry
- Pollen tube growth inhibition
- Stagger intra-plant flower production
- Herkogamy
- Monoecy
- Dioecy
**Visual Cues I: Shape**

- # of axes of symmetry
  - Actinomorphic
  - Zygomorphic
- Depth dimension

**Visual Cues II: Size**

Fig. 6.2

**Visual Cues III: Fluctuating Asymmetry**

Fig. 6.3
Visual Cues IV: Colour

- Pigments
  - Anthocyanins, anthoxanthins
  - Carotenoids
  - Flavones, flavonols
- Epidermal reflectance in nocturnally pollinated flowers
- Colour perception depends on combination of tri- or tetra-chromatic vision receptors

Olfactory Cues

- Cocktails of small cmpds incl. mono- & sesquiterpenes, fatty acids, phenolics
- Long-distance: attraction
- Short-distance: mediate flower visiting behaviour
- Communicate socially relevant information

Auditory Cues

- Petal of *Mucuna holtonii* deflects ultra-sound
- Acts as an auditory nectar guide
Plant Rewards I: Pollen
- Primary reward for eaters, secondary for nectar feeders
- Rich in protein, therefore costly to plant
  - Poricidal anthers
  - Gradually dehiscent anthers

Plant Rewards II: Nectar
- Modified phloem exuded from glands
- Sugars approx. [15-45%]
- Trace amino acids
- Diurnal production

Plant Rewards III: Other
- Oils for larval provisioning or nest construction
- Scents collected by Euglossine bees
- Seeds for offspring
Deceptive Pollination

- Decrease costs to plant
- Frequency-dependent
- Requires naïve pollinators

Pollination Syndromes

| Tab. 6.1 | \begin{tabular}{|c|c|c|c|c|c|c|c|c|c|} 
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Specialization vs. Generalization

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<tr>
<th>Plant species</th>
<th>Quesnelia arvensis</th>
<th>Heliconia angusta</th>
<th>Erythrina speciosa</th>
<th>Nemesia fumosa</th>
<th>Fuchsia carnea</th>
<th>Heliconia velositae</th>
<th>Gasteria marmorata</th>
<th>Acrocomia achatina</th>
<th>Vriesea incrutata</th>
<th>Heliconia rostrata</th>
<th>Dafoiella pinnata</th>
<th>Heliconia spathicincta</th>
<th>Cestus spiralis</th>
<th>Kediumium imbricata</th>
<th>Ctenanthe ornata</th>
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<td>N</td>
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Fig. 6.5
**Handling Time and Constancy**

Fig. 6.6

<table>
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<th>Final</th>
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<tr>
<td>Group 2</td>
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**Specialization vs. Generalization**

- Plant ideal is specialization
- Select for pollinator effectiveness
  - Attraction
  - Manipulation

**Pollinator-Mediated Selection**

- High elevation: long spurs, no aerial bulbils
- Low elevation: short spurs

Fig. 6.7
Pollinator-Mediated Diversification

- Excitement
- Approach
- Pounce
- Pseudocopulation

Fig. 6.10

Flower-Mediated Selection

Fig. 6.11

Flower-Mediated Selection

Figs. 6.12 & 6.13
### Active Pollination Mutualisms
- Fig & Fig Wasp
- Yucca & Yucca Moth
- Senita Cactus & Senita Moth

### Phylogenetic Analyses

### Future Studies
- Native pollinator restoration
- Colony Collapse Disorder