Changing of Plants Over Time

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Learning Outcomes

• Distinguish between monocot and eudicots.
• Understand the major stages in plant evolution.
• Be able to identify key characteristics of major plant groupings.
Outline

- Definitions
- Stages of plant evolution
- Major plant groups
Definitions
What is a Plant?

• A multicellular organism
• Creates sugars from sunlight
• Is made up of a shoot system and root system.
What is Botany?

• The **scientific study of plants**
  • Classification/Evolution
  • Anatomy/Morphology
  • Physiology
  • Uses
What is Horticulture?

• The art and science of cultivating plants, including ornamentals, fruit, and vegetables.
Plant Evolution
Sporic Life Cycle

1. **Egg** (n) ♀
2. **Sperm** (n) ♂
3. **Fertilization**
4. **Zygote** (2n) ♂
5. **Mitosis**
6. **Sporophyte** (2n) ♀
7. **Meiosis**
8. **Spore** (n) ♀
9. **Mitosis**
10. **Gametophyte** (n) ♂
11. **Mitosis**
1. Establishment on Land

**Challenges**
- Dry
- Reproduction

**Adaptations**
- Grow low and close to water
- Water required for reproduction

Gametophyte life stage is dominant.
Key Take Away

• 1st major step is land adaptation.
• Non-vascular plants took this step.
2. Vascular Tissue

Challenges

• Growing taller
• Loosing water
• Gas Exchange

Adaptations

• Vascular Tissue
• Cuticle
• Stomata

Sporophyte life stage is dominant.
Division Lycophyta

Club Moss

Spike Moss

Quillwort
Division Monilophyta (a.k.a Pteridophyta):

- Wisk Fern
- Horsetails
- Ferns
Key Take Away

- 2\textsuperscript{nd} Major step is vascular tissue
- Seedless vascular plants took this step.
3. Seeds

Challenges

• Spores could not survive long
• Distribution
• Extra energy to produce seeds

Adaptations

• Seeds can survive a lot longer
• Seeds could move farther and survive
• Seeds germinated better than spores- worth it.

Sporophyte life stage is dominant.
‘Naked Seed’- not enclosed in ovary.
Three key features of the gymnosperm life cycle are

1. Miniaturization of their gametophytes
2. Production of seeds, a dispersible stage in the life cycle
3. The transfer of sperm to ovules by pollen.
Pinus sylvestris (pine)

Pollen-bearing cone (male cone) with microsporophylls

One year old ovulate cone

Two year old ovulate cone

Young ovulate cone (female cone) with megasporophylls

Ovulate scale (megasporophyll, ovuliferous scale) with two ovules

Bottom view (left), top view (right)

Mature ovulate scale with two winged seeds (left), dispersed seeds (right)
Division Cycadophyta: *Cycas revoluta*, king sago
Division Cycadophyta: *Zamia pumila*, coontie
Division Ginkgophyta, *Ginkgo biloba*
Division Coniferophyta

- These soft wood trees are used in the timber industry. (80% of timber)
- Often used as paper pulp.
- Sap of several species of *Pinus* is used to make turpentine.
Pinaceae, *Pinus clausa*, sand pine
Pinaceae, *Pinus elliottii*, slash pine
Pinaceae, *Pinus palustris*, longleaf pine
Taxodium distichum baldcypress
Key Take Away

- 3rd Major step is seed production
- Gymnosperms took this step.
- ‘Naked-Seed’
- Cycads
- Ginkgo
- Conifers
4. Flowers/Fruit

Challenges

• Pollination
• Seed Distribution

Adaptations

• Flowers with specific adaptations
• Fruit with specific adaptations

Angiosperm means “container seed.”
 Seeds enclosed within an ovary (fruit)
Nonvascular plants

Seedless vascular plants

Angiosperms

- Cycads
- Gingko
- Gnetophytes
- Conifers

Gymnosperms

Seed plants
Angiosperms

- Basal Angiosperms
  - Amborellales
  - Nymphaeales
  - Austrobaileyales
  - Monocots
    - Magnoliidae
      - Laurales
      - Piperales
      - Magnoliids
    - Eudicots
In the real world...

• **Basal Angiosperms and Magnoliids** = 2% of all angiosperms.
  • Examples: water lilies, star anise, magnolias, nutmeg, peperomias

• **Monocots** = 23% of all angiosperms.
  • Examples: grasses, orchids, bromeliads, palms

• **Eudicots** (true dicots) = 75% of all angiosperms.
  • Examples: oaks, roses, cacti, mints, asters
Basal Angiosperms

Water lily
*(Nymphaea “Rene Gerard”)*

Star anise *(Illicium)*

Amborella trichopoda
Magnoliids: Magnolia grandiflora
Members of the Piperaceae, the black pepper family
**Monocots**

1. Flower parts in 3's
2. One cotyledon
3. Parallel venation in leaves
4. Vascular system in scattered
5. No secondary growth

**Eudicots**

1. Flower parts in 4's and 5's
2. Two cotyledons
3. Net venation in leaves
4. Vascular system in a ring bundles
5. Secondary growth (they can make wood.)
Monocot vs. Eudicot

### Monocot Characteristics
- **Embryos**: One cotyledon
- **Leaf venation**: Veins usually parallel
- **Stems**: Vascular tissue scattered
- **Roots**: Root system usually fibrous (no main root)
- **Pollen**: Pollen grain with one opening
- **Flowers**: Floral organs usually in multiples of three

### Eudicot Characteristics
- **Embryos**: Two cotyledons
- **Leaf venation**: Veins usually netlike
- **Stems**: Vascular tissue usually arranged in ring
- **Roots**: Taproot (main root) usually present
- **Pollen**: Pollen grain with three openings
- **Flowers**: Floral organs usually in multiples of four or five
Eudicots     Monocots
Veins in eudicot leaves form a net-like pattern.
Monocot leaves usually have parallel veins.
The vascular tissue in eudicot stems forms a ring.
Vascular bundles are scattered in monocot stems.
Key Take Away

• 4th Major step is Flower and Fruit production.
• Angiosperms took this step.
• Contains many plant groups.
• Monocot vs. Eudicot differences
You Should no be able to

- Distinguish between monocot and eudicots
- Understand the major stages in plant evolution
- Be able to identify key characteristics of major plant groupings.
Questions?