Rinard Orchid Greenhouse Docent Program

Week 2: Plant Anatomy
Objectives

• To introduce general botany for subjects on display
• To provide knowledge of general plant anatomy
• To provide general understanding of orchid anatomy & biology
• To introduce concepts of plant-pollinator interactions
Plant Anatomy

Roots

• Like “straws”, to absorb water and minerals from the soil.

• Tiny root hairs grow from larger roots, help with absorption.

• Help to anchor the plant.

• Store extra food for future use

• Epiphytic (air) roots in many orchids

http://www.mbgnet.net/bioplants/parts.html
http://sbi3u1banj.edublogs.org/2010/05/18/plant-roots/
Stems

Multi-purposes

• Support the plant
• Plant plumbing system
• Conducts water & nutrients from the roots and food (glucose) from leaves to other areas.
• Herbaceous (ex. daisy) or woody (ex. oak tree)
Leaves

• Food (glucose) made in leaves of most plants
• Chloroplasts capture sunlight, convert to food
• Process called photosynthesis
• Petiole – a small stalk attaching leaf blade to the stem.

http://www.mbgnet.net/bioplants/parts.html
http://www.robinsonlibrary.com/science/botany/anatomy/leafparts.htm
Flowers

- Purpose is reproduction
- Mixing of genetic information = out-crossing
- Self-pollinating = inbreeding
- Ovules - tiny flower “eggs”
- Ovule develops into a fruit after pollination of the flower and fertilization.
Flower Parts

- Petals
- Sepals
- Stem
- Female Parts
  - Stigma
  - Style
  - Ovary
- Male Parts
  - Anther
  - Filament

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http://www.just4growers.com/stream/plant-physiology/basic-botany-for-beginners.aspx
http://orchids.green-drop-home.com/src/orchids-dic_e.html
http://en.wikipedia.org/wiki/Gynoecium
Fruits & Seeds

Fruit
• Covering for seeds
• Can be fleshy like an apple or hard like a nut

Seeds
• Form inside fruit
• Contain beginnings of new plants

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Why are Orchids Special?

- Largest family of flowering plants
- World-wide (except Antarctica)
- Greatest abundance in tropics
- Epiphytic (‘air’) & terrestrial forms
- Varied growth forms – many unusual
- Seeds tiny & numerous
- Unusual, varied mechanisms to attract pollinators
- As group, very successful, highly evolved
- Valued and collected for centuries

http://www.merklesorchids.com/CulturePgs/whatsanorchid.htm

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What is an Orchid?

Two defining characteristics

• Parts in 3’s
  • 3 sepals
  • 3 petals - 1 modified petal (lip, labellum or ‘landing pad’)

• Column
  • Fusion of male and female reproductive structures
  • Nose-shaped
  • “Business end” of flower

Phalaenopsis (moth orchid) from Asia

http://www.merklesorchids.com/CulturePgs/whatsanorchid.htm
Orchid Variations

Corsage Orchid
- Lip broad, showy
- Column nose-shaped
- Petals/sepal similar

Slipper Orchid
- Lip pouch-shaped (temporary trap)
- Column flattened
- Parts fused (ex. 2 sepals into 1 lateral sepal)

http://www.merklesorchids.com/CulturePgs/whatsanorchid.htm

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Orchid Structure

• Roots
  • Aerial or ground-dwelling

• Stems
  • Typical
  • Modified – Pseudobulb or cane
  • Growth upright (Monopodial – ‘one foot’) or creeping (Sympodial – ‘many feet’)

• Leaves
  • Thick, thin, or absent

• Flowers
  • Every color except black

• Seeds – dust-like

http://www.merklesorchids.com/CulturePgs/whatsanorchid.htm
Orchid Roots

- Epiphytic
  - Literally “on”-plant, anchoring
  - Mostly tropical
  - Absorptive layer: *velamin*
  - Photosynthetic
- Terrestrial
  - Ground-dwelling
  - Mostly temperate
  - Sometimes saprophytic
- Lithophytic
  - On rocks

http://www.flickr.com/photos/dinilu/8518365908/
http://www.westford.com/fingerhut/Flowers.htm
http://www.merklesorchids.com/CulturePgs/whatsanorchid2.htm
Orchid Stems

- Simple stems
  - Terrestrial orchids
  - Cloud forest orchids

- Pseudobulbs
  - Food and water storage organs
  - Typical of plants with seasonal or temporal variations
  - Various shapes and sizes

- Canes
  - Long, narrow food storage organs
  - Typical of orchids with pronounced dry/wet seasons

http://forum.theorchidsource.com/ubbthreads.php/topics/122381.html
Orchid Leaves

- Parallel leaf venation
- Structure of the leaves corresponds to the specific habitat

Leaf Types

- **Conduplicate** - thick or leathery
  - Waxy cuticle to retain water
  - Defined midline
  - Drains water well
- **Soft-herbaceous** - often terrestrial, w/ dormancy
- **Reticulate** - network
- **Primitive plicate** - pleated
Orchid Flowers

- **Purpose**
  - Reproduction
  - Attract pollinator

- **How structures work**
  - Anther cap protects pollen
  - Anther cap removed when pollen removed
  - Waxy pollen in 2 – 4 ‘packets’
  - Pollen sticks to pollinator
  - Pollinator visits another flower
  - Stigma (female) concave pocket, below /behind
  - Pollen sticks to stigma for fertilization

http://www.merklesorchids.com/CulturePgs/whatsanorchid.htm
Orchid Seeds

- Pollination produces tiny seeds
- 1300 to 4 million per pod
- Wind-dispersed
- Tiny seeds lack endosperm (stored food)
- Symbiotic mychorrhizal fungi - in all orchids
- Fungi needed for seed germination
- Fungi invade orchid roots
- Fungi provide carbon (energy) for developing orchid seed
- Many adult orchids retain fungi (benefit unknown)
Orchid Pollination

http://www.merklesorchids.com/CulturePgs/whatsanorchid.htm
Pollinator & Flower Color

- **Bees** - visit yellow, blue, purple flowers.
- **Butterflies** - visit red, orange, yellow, pink, and blue flowers.
- **Moths** - visit white and light-colored flowers. Moths are almost exclusive pollinators for white flowers with long nectar spurs.
- **Flies and gnats** - visit green, brown, burgundy, white or cream colored flowers.
- **Bats** - rare as orchid pollinators, visit large light-colored night-scented flowers.
- **Hummingbirds** - visit red, orange, purple/red tubular flowers.
Orchids & Pollinators

- Highly specialized relationship between orchid and pollinator
  - 1 to 1 relationship

- Based on:
  - Flower color
  - Flower shape
  - Flower size
  - Timing of flowering
  - Flower scent
  - Flower markings

Image: Cleblanc; http://www.weloennig.de/CorCat.html