Diversity and Evolution of Rosids

. . . violets, willows, and spurge . . .

**Oxalidales**

- small, heterogeneous, novel group of 6 families - seed character?

Oxalidaceae - wood sorrels

6 genera, 770 species in the tropics and temperate areas - 700 belong to *Oxalis* (wood sorrel)

- plants are herbaceous creepers or woody vines

*Cephalotaceae*

Australian pitcher plant

**Oxalidaceae**

- wood sorrels

6 genera, 770 species in the tropics and temperate areas - 700 belong to *Oxalis* (wood sorrel)

*Oxalis corniculata* - creeping yellow wood sorrel

- typically 3-lobate leaves (the real shamrock)
- leaves are acidic to taste due to oxalic acid in the form of calcium oxalate
Oxalidaceae - wood sorrels

- 5 merous flowers
- fruits are 5 locular & winged capsules or berries

Oxalis corniculata

- tristyly common (3 levels at which 2 sets of anthers and 1 set of styles position)

Oxalis acetosella - wood-sorrel

- common native and introduced wood-sorrels

Oxalis stricta - tall wood-sorrel

- tropical fruit - carambola or star fruit: note 5 carpellate structure

Averrhoa carambola
**Malpighiales**

- large and diverse group of 38 families - many of them contributing importantly to tropical forest diversity

**Malpighiales**

- unresolved! “novel” clade
- leaf margin teeth
- “Parietales” subclade (placentation)
- hosts for *Cymothoe* butterflies

**Malpighiales**

- unusual life forms

*Rafflesia* (parasite)
- *Rafflesia* - stream aquatic
- *Podostemaceae*
- *Podostemum*
- *Rhizophoraceae* - *Rhizophora mangle* - mangrove

**Violaceae - violets**

23 genera, 800 species of herbs (temperate) to vines and small trees (tropics). 400-600 of them are violets (*Viola*).

*Viola tricolor* - pansy, Johnny jump-up

*Rinorea* - tropical shrub
**Viola** have either basal leaves or cauline leaves - cordate or palmately lobed or divided.

Stipules are well developed.

- Flowers insect pollinated, nectar guides, zygomorphic.
- Perianth 5 merous.
- Lower petal spurred, 2 lower stamens have spurs going back into the petal spur.
- 3 fused carpels.

Pistil forms 3 parting capsule in chasmogamous flowers (open flowers) from out-crossing.

Cleistogamous, or closed flowers, form small capsules via self-pollination (note the parietal placentation in upper capsule).

*Viola* affinis - sand violet.

V. pedatifida - Prairie violet.

V. pedata - Bird's foot violet.

*Violaceae - violets*
V. sororia - dooryard violet
Wisconsin state flower! One of many stemless purple violets

V. macloskeyi - Wild white violet
A small white flowered violet

*Violaceae - violets

V. pubescens - downy yellow violet
A stemmed yellow violet

V. canadensis - Canada white violet
A stemmed white violet

Hybanthus concolor - green violet
Special concern, almost extirpated

*Violaceae - violets

* tropical taxa of other genera and Viola are woody
* from where did the 10 species in Hawaii come?
*Violaceae - violets

DNA places them within a polyploid complex, amphi-Beringian tundra species

V. langsdorffi

*Violaceae - violets

Beringian source is rare, especially surprising with a group once considered tropical

bird migration pathway from Beringia to Hawaii is common and potential mechanism of dispersal

Hypericaceae - St. John’s wort

9 genera, 560 species of temperate herbs or small shrubs

- opposite leaved
- leaves are punctate - with clearly visible clear to black dots, these sometimes seen on petals as well

Hypericum perforatum - Klamath weed (ecologically invasive)

Stamens many, often grouped

Note the perforations along edge of yellow petals
Hypericaceae - St. John’s wort

- Pistil made up of 3 to 5 fused carpels
- Placentation either axile (then 3-5 locules) or parietal (as here)

Hypericum pyrimidatum, great St. John’s wort

- Fruit a capsule

Hypericaceae - St. John’s wort

*Salicaceae - willows, poplars

Chemically defined by salicins (salicylic acid). Many members of the tropical “Flacourtiaceae” with showy flowers also have salicins and are now part of the Salicaceae.

Hypericum pyrimidatum, great St. John’s wort

- Hypericum common in high elevation regions of tropics
- Triadenum restricted to wetlands

Triadenum virginicum, marsh St. John’s wort

*Dovyalis hebecarpa

Oncoba spinosa
*Salicaceae - willows, poplars

55 genera, 1000+ species of shrubs/trees - 450 are willows (*Salix*), less numerous are poplars, aspens (*Populus*).

- *Salix babylonica* - weeping willow
- *Salix discolor* - pussy willow

Willows (*Salix*) are dioecious trees of temperate regions with reduced flowers in aments - both insect and wind pollinated.

- Male
- Female

- Nectar glands at base of bract allows insect as well as wind pollination.
- Fruit is a capsule with cottony seeds for wind dispersal.

- Many species are “precocious” - flower before leaves flush in spring.
*Salicaceae - willows, poplars

- species vary from large trees, shrubs, to tiny tundra subshrubs

*S. alba
White poplar
Introduced from Europe

*Salicaceae - willows, poplars

- flowers possess a disk
- cottony seeds in capsule

P. deltoides
American cottonwood

P. grandidentata
Bigtooth aspen

P. tremuloides
Trembling aspen

P. balsamifera
Balsam poplar, balm-of-gilead

P. alba
White poplar
Introduced from Europe

*Salicaceae - willows, poplars

- aspens are clonal from root sprouts, fast growing, light wooded, and important for pulp in the paper industry
**Salicaceae - willows, poplars**

*Populus deltoides*
American cottonwood

**Euphorbiaceae - spurges**

Euphorbiaceae s.l. is polyphyletic and now broken into 3 families

*Phyllanthaceae*

*Putranjivaceae*

*Euphorbiaceae*

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**Euphorbiaceae - spurges**

- Large cosmopolitan family of trees, shrubs, and herbs of 222 genera and 6000 species
- latex bearing and filled with nasty chemicals (source of rubber, castor oil, tapioca, poinsettia)
- leaves alternate, simple (often palmately lobed) or palmately compound

*Ricinus - castor oil bean*

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**Euphorbiaceae - spurges**

- Majority of the family has unisexual flowers, 5 sepals, no petals, numerous stamens, 3 fused carpels, and capsules

- CA 5   CO 0   A 0   G 0
- CA 5   CO 0   A 0   G (3)
A quite different arrangement of unisexual flowers is seen in many of our spurges of the genera *Euphorbia* and *Chamaesyce*.

The "flower" of our flowering spurge is actually a highly modified inflorescence = cyathium.

Cyathium is composed of:
glands
appendages of glands.
**Euphorbiaceae - spurges**

Cyathium is composed of:
- glands
- appendages of glands
- 1-stamened male flowers (no perianth)

1-tricarpellate female flower (3 styles)

Euphorbia esula - leafy spurge

- one of several species labelled "obnoxious weed" by state law

Euphorbia is a "plant" genus (> 2,000 spp.) with some spectacular radiations - is the cyathium a "key innovation"?
*Euphorbiaceae - spurge*

Economically important members from Neotropics

- *Manihot esculenta* - manioc, cassava, tapioca
- *Hevea* - rubber

- Besides its use as a poison, what other features does *Hura crepitans* possess that makes it a pretty nasty plant?

Passifloraceae - passion flower

Spectacular group of vines and trees in the pantropics - one ingredient of Hawaiian punch

- parietal placentation
- berry fruit

Passifloraceae - passion flower

Co-evolutionary relationships involving leaf shapes, Heliconid butterfly egg layers, extrafloral nectaries, and patrolling ants
**Linaceae - flax**
A small family of herbs most noted as the source of flax (linen), linseed oil, and base chemicals for linoleum.

**Linum**
- *Linum sulphureum* - grooved yellow flax
- *Linum narbonense* - grooved yellow flax

**Rhizophoraceae - mangroves**
Asian and Madagascar tropical trees and one widespread mangrove

**Rhizophora**

**Malpighiaceae - malpighs**
Diverse woody family of pantropical region with distinctive clawed petals and floral nectaries.

**Malpighia**
- *Malpighia emarginata*

**Hiptage**