Diversity and Evolution of Rosids

... cacao, mustard, and capers ...
1. leaves palmately veined (simple or compound)
2. sepals valvate - not overlapping
3. stellate hairs

*Malvaceae - mallows

Sphaeralcea  Hibiscus trionum  Hibiscus tiliaceus

**Malvaceae - mallows**

4. Many stamens, often bundled, sometimes monadelphous into a staminal tube

CA 5  CO 5  A (∞)  G (5-∞)

Grewia  Hibiscus

**Malvaceae - mallows**

"malvoids"

Althaea - hollyhock, marshmallow

Malva - mallow, cheese

Hibiscus

**Malvaceae - mallows**

"malvoids"

*Malva - mallow, cheese*

Gossypium - cotton

Napaea dioica - glade mallow

• only Midwestern endemic genus
*Malvaceae - mallows

“tilioids”

Tilia americana - basswood, linden

Central America

*Malvaceae - mallows

“bombacoids”

Adansonia - baobabs

Pseudobombax

*Malvaceae - mallows

“sterculoids”

Theobroma - “food of the gods,” cacao, chocolate

Cola

*Brassicales

• 17 families
• morphologically diverse!

glucosinolates

myrosinase enzyme

isothiocynates mustard oils
*Brassicales

Capparaceae - capers

Tropaeolaceae - garden nasturtium

Criciferae - papaya

*Brassicaceae - mustard

Large (338 genera / 3710 species), complex family of mustard oil producing herbs (broccoli, brussel sprouts, cauliflower, kale, cabbage); Arabidopsis - genetic/genome model plant species

*Brassicaceae - mustard

• flowers “cross-like” with 4 petals, six stamens with 2 outer ones shorter - derivation of “Cruciferae” or “cross-bearing”

Cardamine concatenata - cut leaf toothwort

Cardamine protensis - cuckoo flower

*Brassicaceae - mustard

CA 4 CO 4 A 4+2 G (2)

• gynoecium of 2 fused carpels separated by thin membrane with ovules in a parietal fashion

Cardamine pratensis - cuckoo flower

• fruit is a capsule that peels off the two outer carpel walls exposing the papery membrane or septum attached to the persistant replum

Arabidopsis thaliana
**Brassicaceae - mustard**

- Fruits are called siliques or silicles based on how the fruit is flattened relative to the septum.
- Siliques flattened contrary to septum.
- Silicle flattened parallel to septum.

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\begin{array}{ll}
\text{CA} & 4 \\
\text{CO} & 4 \\
\text{A} & 4+2 \\
\text{G} & (2)
\end{array}
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Shape of fruits appear to have diversified rapidly in the family - unfortunately infra-familial classification has been largely based on the fruit.

- *Brassicaceae - mustard*

- Aethionema - Mediterranean region - is sister to rest of family.

*Cordamine concatenata* - cut leaf toothwort.

*Cordamine douglasii* - purple spring cress.

- Common spring flowering woodland herbs.
*Brassicaceae - mustard

* Nasturtium officinale - water cress
  - edible aquatic native with a mustard zing

* Hesperis matronalis - Dame's rocket
  - Introduced or spreading

* Barbarea vulgaris - yellow rocket, winter cress

Alliaria petiolata - garlic mustard

* Myrtales
  - strongly supported order of 12 families
  - defined by 2 anatomical features
**Myrtales**

- this combination placed the anomalus Vochysiaceae within Myrtales
- 3 very large tropical families

**Melastomataceae**

**Heterotruchum**

**Combretaceae**

**Psidium - guava**

**Metrosideros - ohia**

**Vochysiaceae**

Diversification analyses identify three significant shifts in speciation.
Near or just within the crown radiations of these three families.

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**Onagraceae - evening primrose**

A moderate sized family of 17 genera and about 650 species - most diverse in western N. America

**CA 4 CO 4 A 4.8 G (4)**

- 4 merous flowers, epigynous, and often well developed hypanthium

**Onothera biennis - evening primrose**

*Ludwigia* is sister to remainder of the family

*tropical Fuchsia* is diverse in South America
**Onagraceae - evening primrose**

*Chamerion angustifolium* - fireweed

*Circaea lutetiana* - enchanter’s nightshade

- 2 merous flowers; fruit is one-seeded and bristly

*Circumboreal Circaea is sister to woody southern hemisphere Fuchsia*

- Flowers 4, 5, or 6 merous with stamens double the number of sepals and in two distinct sets
- Exhibits tristylos heterostyly
- Hypanthium well developed but with superior pistil = perigynous

**Lythraceae - loosestrife**

*Lythrum salicaria* - purple loosestrife

Ecologically invasive in wetlands; from Europe

*Lythrum alatum* - winged loosestrife

Lythrum alatum - winged loosestrife

- Close relative of the evening primrose family; mainly tropical in distribution

CA 4-6, CO 4-6, A 8-12, G (4)

Cuphea - cigar plant

Trapa - water chestnut
Geraniales: Geraniaceae

Poorly understood order of 6 families – now placed next to Myrtales.

Geranium family: 800 species of temperate herbs.

Geraniaceae - geranium

• 5 merous flowers with a superior pistil made up of 5 carpels each with a single ovule.

Geranium maculatum - wild geranium

Geranium robertianum - Herb Robert

Erodium cicutarium - stork’s-bill

The stork’s-bills of genus Erodium drill their mericarps into the ground.

Vitales: Vitaceae - grapes

Order with one family: sister to all other Rosids.

Vitis - grape
Vitales: Vitaceae - grapes

Small family (800 species) of vines in the tropics and temperate areas - includes *Vitis vinifera* the wine grape

- flowers small and clustered in more showy inflorescences
- fruits: berries with several seeds

*Parthenocissus tricuspidata* - Boston ivy

*Vitis* - grape

**Vitaceae - grapes**

- leaves simple or compound; venation and lobing usually strongly palmate
- plants climb by tendrils = modified inflorescences, or by holdfasts

*Parthenocissus* - Boston ivy

*Vitis aestivalis* - Summer grape

*Vitis riparia* (+ *V. vulpina*)
River, frost grape

*Parthenocissus quinquefolia* - Virginia creeper, woodbine

*Vitis* - grape