Diversity and Evolution of Asterids

... gentians, milkweeds, and potatoes ...

Core Asterids

- two well supported lineages of the ‘true’ or core asterids
- ‘lamiid’ or Asterid I group
- ‘campanulid’ or Asterid II group
- appear to have the typical fused corolla derived independently and via two different floral developmental pathways

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Early vs. Late Sympetalaly

euasterids II - campanulids

Calendula, Asteraceae

early

also in Cornaceae of “basal asterids”

euasterids I - lamiids

Anchusa, Boraginaceae

late
**Gentianales**

- Order within 'lamiaid' or Asterid I group
- 5 families and nearly 17,000 species dominated by Rubiaceae (coffee) and Apocynaceae (milkweed)
- Iridoids, opposite leaves, contorted corolla

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**Gentianaceae - gentians**

Cosmopolitan family of 87 genera and nearly 1700 species. Herbs to small trees (in the tropics) or mycotrophs.

- Opposite leaves
- Glabrous - no hairs!
- Flowers right contorted
**Gentianaceae - gentians**

- Gentiana
  - flowers 4 or 5 merous
  - pistil superior of 2 carpels
  - parietal placentation; fruit capsular

- Gentiana andrewsii - Bottle gentian
- Gentiana puberulenta - Prairie gentian

**Gentianopsis**

- Gentianopsis is 4 merous, with fringed petals

- Gentianopsis procera - fringed gentian

**Gentianella**

- Gentianella is 4-5 merous, without fringe, and without plaits between petal lobes

- Gentianella crinita - fringed gentian
- Gentianella quinquefolia - stiff gentian
**Gentianaceae - gentians**
- Woody gentians common in cloud forests of the Neotropics
- Hummingbird, bat, and bee pollinated radiations

*Symbolanthus*  
*Lisianthus*

**Apocynaceae - milkweeds**
Worldwide family of trees, vines, herbs with opposite leaves - 415 genera, 4600 species.

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*Catharanthus roseus*  
*Asclepias syriaca*  
*Caralluma europae*  
*Vincia minor* - periwinkle  
*Pachypodium*  
*Periploca*  
*Milky latex*  
*Asclepias syriaca* - common milkweed  
*Gambieria* - Malagasy periwinkle  
*Curare vine - South America*  
*Cardiac glycosides*  
*Vincia minor* - periwinkle  
*Caralluma europae* - cactus mimic  
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**Apocynaceae - milkweeds**

Family is broadly defined and includes distinctive milkweeds of old family Asclepiadaceae.

Transition to more elaborated 'milkweed' flowers

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**Apocynaceae - milkweeds**

- flowers 5 merous
- left contorted perianth
- 2 separate carpels - follicles

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**Apocynaceae - milkweeds**

- pollen presentation - style plunger or bottle brush to expose pollen

- 5 stamens begin to be connivent

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**Apocynaceae - milkweeds**

- stamens fuse to each other and to style region - gynostegium
- pollen forms pollinia
- more seeds with tufts of hairs
*Apocynaceae - milkweeds

Note 2 free carpels slightly fused at top

Corona for nectar reward

Corona = hood + crest

*Apocynaceae - milkweeds

Corona = hood + crest

Gynostegium = A + G

*Apocynaceae - milkweeds

Fusion of 5 stamens and top of gynoecium

Gynostegium = A + G

*Apocynaceae - milkweeds

Gland is attached to 2 pollinia

Corona = hood + crest

Gynostegium = A + G

Pollinia = pollen mass
*Apocynaceae - milkweeds

Gland is attached to 2 pollinia
Corona = hood + crest
Gynoestegium = A + G
Pollinia = pollen mass

Bee removing pollinia or inserting pollinia into stigmatic cleft

Pollination of milkweeds – 2nd part
*Apocynaceae - milkweeds

“Las Vegas” strategy of pollination; but when occurs, all ovules are fertilized. Typically few follicles are produced per plant. Note seeds with coma attached for wind dispersal.

Asclepias amplexicaulis - Clasping milkweed

Apocynum androsaemifolium - Spreading dogbane

Apocynum sibiricum - Hemp dogbane

Asclepias syriaca - Common milkweed

Asclepias tuberosa - Butterfly weed

Asclepias incarnata - Swamp milkweed
*Rubiaceae - coffee

Cosmopolitan family, most diverse in tropics, of 550 genera and over 10,000 species

- trees, shrubs, lianas, and herbs
- important drug family

- opposite (whorled) leaves with inter-petiolar stipules

Psychotria nervosa

*Cinchona* - quinine

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Houstonia caerulea - azure bluets

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- opposite (whorled) leaves with inter-petiolar stipules

Galium (bedstraw) - are these stipules?

Galium aparine - cleavers

Cleavers and bedstraws are numerous; separated by number of whorled leaves and fruit type

Galium aparine - cleavers

Pentagonia Panama

Galium - bedstraw Wisconsin

Galium (bedstraw) - are these stipules?
*Rubiaceae - coffee

**Houstonia caerulea** - azure bluets

**Rubiaceae - coffee**

*Mitchella repens*

Partridge berry, twin-berry

Note: paired flowers above with connate pistils; “twin” berry to right

*Rubiaceae - coffee

**Cephalanthus occidentalis** - buttonbush

Only shrub in Wisconsin; note “heads” of tiny 4 merous flowers “pseudanthia”

*Rubiaceae - coffee

**Isertia**

*Coffea arabica** - coffee
The giant genus *Psychotria* is paraphyletic and includes more specialized genera (e.g., condensed, bracted inflorescences) “pseudanthia”!

The genus *Hydnophytum* - ant plants and epiphytes - along with the whole subtribe Hydnophytinae - are now shown to be derived out of the genus *Psychotria*!

The order Solanales - 'lamiids' or Asterid I group
- 5 families and nearly 5,000 species dominated by *Solanaceae* (nightshade) and *Convolvulaceae* (morning glory)
- no iridoids, alternate leaves, plicate corolla, calyx persistent in fruit
**Solanaceae - nightshades**

Large cosmopolitan family of herbs, shrubs, or trees with nasty compounds. Important for source of foods (potato, tomato, pepper) and drugs.

- Alternate-leaved
- Cyme or dichasium inflorescence

*Brugmansia*  
*Nicotiana - tobacco*  

**Solanum dulcamara** - Bittersweet

CA (5)  CO (5)  A 5  G (2)

- 5-merous flowers
- axile placentation
- berry fruited

*Brugmansia*  
*Nicotiana - tobacco*  

**Solanum carolinense** - Horse nettle

CA (5)  CO (5)  A 5  G (2)

- stamens often terminal pored for buzz pollination by bees (remember Ericaceae?)

*Solanum carolinense - Horse nettle*

***Physalis alkekengi - Japanese lantern***

- often calyx persistent in fruit

*Solanum dulcamara - Bittersweet*
*Solanaceae - nightshades

*Solanum dulcamara - Bittersweet

*Solanum carolinense - Horse nettle

*Physalis virginiana
Ground cherry
Note: calyx surrounding berry

*Capscium - pepper
*Solanum - tomato & eggplant

Botany 400 collections species!
*Solanaceae - nightshades

* Atropa belladona

Belladonna means “beautiful lady” – women used to take “atropine” to make pupils dilate

Belladonna Took – mother of Bilbo Baggins

* Nicotiana tabacum

* Datura stramonium

Introduced, hallucinogenic roadside weed . . . also called thorn-apple
**Solanaceae - nightshades**

* Datura stramonium
  
  Jimson-weed
  
  Introduced, hallucinogenic roadside weed
  
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**CASE REPORT**

**Jimson Weed Intoxication in Five Adolescents**

James V. Leonard, DDS, South Korea, MD

**INTRODUCTION**

Introduction: Jimson weed (Datura stramonium) is a non-native, psychoactive plant commonly found throughout the United States. It contains active substances, including scopolamine and hyoscymine, that can cause hallucinations, delirium, and fever. Jimson weed is illegal in the United States and is often used as a hallucinogen by adolescents and young adults. There are no known treatments for Jimson weed ingestion, although supportive care and monitoring are necessary.

**Case 1**

A 19-year-old male presented to the ED with a 12-hour history of agitation, confusion, and personality changes. Blood pressure was 120/80 mm Hg, and pulse was 110 bpm. Activated charcoal was administered. Shortly after admission to the ICU, he became aggressive, combative, and even attempted to stand on a bedside table and fly to escape from the room. Subsequently, he was sedated with intravenous haloperidol. Discharge occurred after 24 hours with normal vital signs and mental status.

**Case 2**

A 15-year-old male was brought to the ED by the police after he had been found crawling down a busy street in an agitated state. He was picking at objects on his body that were not present. His only comprehensible words were obscenities. Blood pressure was 134/84, and pulse was 154 beats per minute. Skin was dry and flushed. Ultrasound-guided venous access was obtained. Activated charcoal was administered. Blood pressure and temperature remained stable. Pulse ranged from 40 to 109 beats per minute with sinus rhythm. He was sedated in recovery and discharged 40 hours later with normal vital signs and mental status.

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*Wisconsin Medical Journal 2005*