Laboratory 9: "Basal" Angiosperms 1

With today's lab we begin our survey of flowering plant families. Despite of all the diversity in angiosperm floral and vegetative morphology, remember that there are a number of features (synapomorphies) that unite the angiosperms. In particular, the ovules are contained within a carpel that, with very few exceptions, has become completely closed. As a result, pollination is indirect. Additionally, the xylem is composed of both tracheids and **vessel elements** (except in the Amborellaceae and Winteraceae). Other characters include the highly reduced nature of both the microgametophyte and megagametophyte generations as well as the phenomenon of double fertilization.

Also note that flowers are actually determinate, reproductive shoots composed of both sterile appendages (*i.e.* the petals and the sepals) and fertile appendages (*i.e.* the stamens and the carpels). All of these appendages are leaf homologues. That is, they are leaves that have become modified in the course of evolution and now perform very specific functions.

As you examine the different flowering plant families, pay particular attention to the floral characters since it is these characters that usually form the basis of familial classification schemes. Vegetative features are also important but many families cannot be distinguished on the basis of vegetative features alone.

See p.127-149 in the Simpson textbook for more information. You are NOT responsible to know families marked with an asterisk (*).

Amborellales

Amborellaceae* – 1 genus, 1 sp., New Caledonia

Shrub to small tree, **lacking ethereal oils**, wood without true vessels; **leaves alternate and 2-ranked**, finely toothed; **dioecious**; flowers radial, composed of many (5-11) distinct tepals, borne in axillary cymes; **stamens many, poorly differentiated**; carpels 5-6, ovaries superior; pistillate flowers with one to several sterile staminodes.

Amborella trichopoda

Nymphaeales

Nymphaeaceae (including Cabombaceae) – 8 genera, 81 spp., Aquatic, widely distributed

Aquatic, herbaceous, leaves alternate, generally large with long petioles, **floating blade**; stipules lacking; flowers bisexual and radial; sepals four to six in number, generally distinct; **petals eight to many**, generally distinct; **flowers generally large and showy**; **stamens numerous**, generally distinct; ovary may be inferior or superior, **composed of five to many fused carpels**; style absent, stigmas large and discoid, distinct.

Nuphar
Nymphaea
Cabomba

Austrobaileyales

Austrobaileyaceae* – 1 genus, 1 sp., Queensland (Australia)

Evergreen woody vine with ethereal oils; flowers **bisexual**; leaves opposite; flowers large, solitary in the axils of leaves; composed of ~20 tepals, spirally arranged, ranging from sepaloid to petaloid; stamens many, poorly differentiated, **purple dotted**, inner stamens reduced to staminodes; carpels 10-13 free, spirally arranged, **style 2-lobed**; flowers smell like rotting fish (presumably pollinated by flies).

Austrobaileya scandens

Illiciaceae – 1 genus, 42 spp, Asia and SE United States-Caribbean

Leaves spirally arranged (often appearing whorled or alternate); no stipules; trees or shrubs **with ethereal oils**; **flowers bisexual**, ± regular; tepals seven to many, distinct; stamens numerous, distinct; carpels five to twenty, superior, each with a single locule and one ovule per carpel**, arranged in a whorl about the floral axis; fruit is star shaped**.

Illicium

Ceratophyllales

Ceratophyllaceae* – 1 genus, 2-6 spp.

Leaves very reduced, forked, **whorled** with between three and ten leaves per node; **submerged**, **aquatic herb without roots**; flowers **unisexual**; perianth of between eight and twelve bract-like segments; stamens numerous; superior ovary of one carpel having a single locule with one ovary.

All families that follow are in the MAGNOLIID group.

Laurales

Calycanthaceae* – 4 genera, 10 spp., Australia, China, and US

Leaves opposite, simple, no stipules; shrubs **with ethereal oils** causing aromatic bark; flowers perfect, regular; numerous tepals, distinct; stamens numerous, **distinct; stamens and perianth segments attached to the edge of a cup-like receptacle**; carpels numerous, inserted on the receptacle, distinct, superior, each with a single locule with one or two ovules.

Calycanthus

Lauraceae – 52 genera, ~2850 spp., tropical and warm temperate

Leaves may be alternate or opposite but are typically **fragrant due to ethereal oils**; no stipules; may be trees or shrubs; flowers are regular but may be either unisexual or bisexual; **perianth segments reduced, in multiples of three**; stamens numerous, adnate to the base of the perianth with (ususally) **introrse dehiscence**; one carpel, typically superior (but may be inferior) with a single locule containing one ovule.

Cinnamomum
Laurus
Persea
Sassafras
Umbellularia

Magnoliales

Annonaceae* – 112 genera, ~1250 spp., mostly tropical

Leaves alternate, simple, entire, in two ranks; no stipules; trees or shrubs **with ethereal oils**; flowers perfect, **regular; perianth generally in 3 whorls of 3 parts**, free or connate at their base; stamens numerous, distinct; three to many carpels, superior, each with a single locule with one to many ovules; seeds with ruminate endosperm.

Annona
Asimina
Cananga

Degeneriaceae* – 1 genus, 2 spp., Fiji

Large trees **with ethereal oils**; leaves alternate, simple and entire; no stipules; **flowers large, solitary, and pendulous on long peduncles**; flowers regular and bisexual with three sepals and 12-18 petals in 3-5 whorls; stamens numerous, distinct; frequently sterile staminodes occur between stamens and carpels; one **carpel, superior, *open* when immature**; one locule with numerous ovules.

Magnoliaceae – 7 genera, 165 spp., tropical and temperate

Leaves alternate, simple; stipules present, sometimes "furry"; **trees or shrubs with ethereal oils**; flowers perfect, regular, large and showy; **tepals attached to an elongated receptacle in several whorls of three**; stamens numerous, distinct; carpels numerous, generally distinct, superior, each with a single locule each having between one and five ovules per carpel.

Liriodendron
Magnolia
Michelia

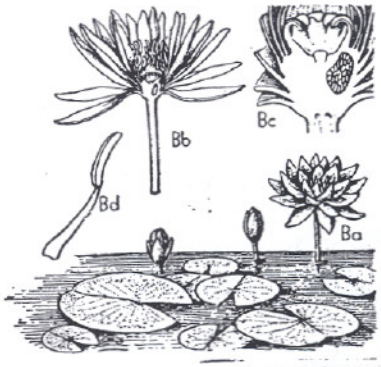
Canellales

Winteraceae – 4 genera, 60 spp., South America west to Madagascar

Leaves alternate, simple, entire; no stipules; trees and shrubs; **leaves glaucous underneath**; wood without vessels; flowers regular and generally bisexual; floral appendages numerous and distinct; **carpels stalked, with partially free margins (*i.e.* unsealed stigmatic margins)**; one locule per carpel, each with few to numerous ovules.

Drimys
Tasmannia

Piperales – next time…



Nymphaeaceae
water-lily family

B, *Nymphaea odorata*: Ba, flowering plant, much reduced; Bb, flower, vertical section, × ¼; Bc, same, less perianth, × 1; stamen, × 1. (From L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

from Lawrence's Taxonomy of Vascular Plants

ILLICIACEAE. ILLICIUM FAMILY

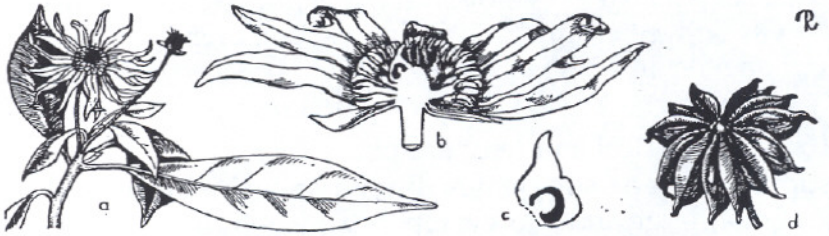


Fig. 141. ILLICIACEAE. *Illicium floridanum*: a, flowering branch, × ⅓; b, flower, vertical section, × 1; c, pistil, × 2; d, fruits, × 1. (From L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

ANNONACEAE.[81] CUSTARD-APPLE FAMILY

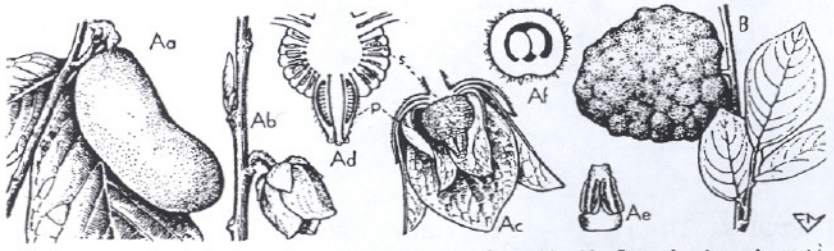


Fig. 144. ANNONACEAE. A, *Asimina triloba*: Aa, fruit, × ¼; Ab, flowering branch, × ½; Ac, flower, perianth excised, × 1; Ad, same, vertical section, less perianth, × 2; Ae, stamen, × 5; Af, ovary, cross-section, × 10. B, *Annona Cherimola*: fruit, × ⅙. (p pistil, s stamens.) (From L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

LAURACEAE. LAUREL FAMILY

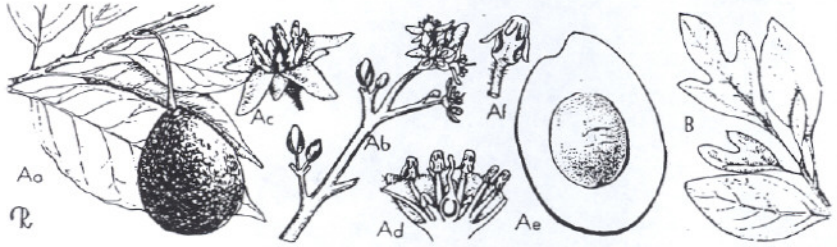


Fig. 147. LAURACEAE. A, *Persea americana*: Aa, fruiting branch, × ⅙; Ab, twig with flowers, × ½; Ac, flower, × 1; Ad, same, vertical section, × 2; Ae, stamen (basal portion of filament removed), × 5; Af, fruit, vertical section, × ¼. B, *Sassafras albidum*: foliage, × ¼. (After L. H. Bailey, *Manual of Cultivated Plants*, The Macmillan Company, 1949.)

MAGNOLIACEAE. MAGNOLIA FAMILY

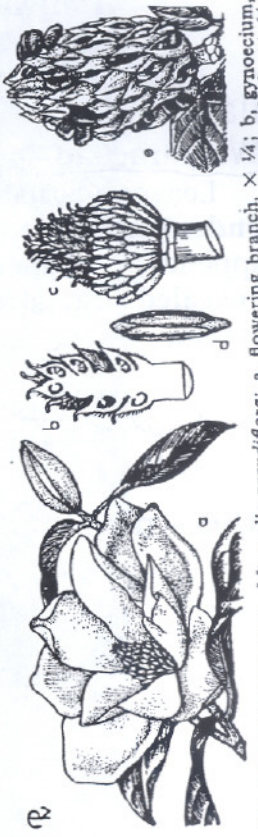


Fig. 140. MAGNOLIACEAE. *Magnolia grandiflora*: a, flowering branch, × ¼; b, gynoecium, vertical section, × ½; c, flower, less perianth, × 2; d, stamen, × ½; e, fruit, × ¼. (Redrawn from Sargent.) (From L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

Deciduous or evergreen trees or shrubs; leaves alternate, simple, mostly entire, petioled, pinnately veined, the stipules usually present and then enclosing the young bud, early deciduous and leaving a circular scar; flowers bisexual (except *Kmeria*)