**Eudicots—Ranunculales and Proteales\***

In this lab, we will begin to explore different families in the Eudicotyledoneae. Families will be presented to you based on their placement in the currently accepted eudicot phylogeny (Moore *et al*. 2010). You will be responsible for each family presented in lab and will be expected to know general family characteristics and to identify specimens to the families presented. We will not be exhaustively covering eudicot families but will focus on those that are either found commonly in Georgia or are of special interest.

Today you will be looking at Ranunculaceae, Papaveraceae and Berberidaceae of the order Ranunculales and Platanaceae of the order Proteales. These two orders are in the basal eudicots, which also include *Ceratophyllum*, Buxales, Trochodendrales and Sabiales. Answer the following questions regarding each family.

**Identifying Family Characteristics**

1. **Platanaceae—the plane-tree family**

There is only one species of this family native to eastern North America, *Platanus occidentalis*, or the American sycamore.

* 1. If available, look at the material provided, and derive the floral formula.
  2. Use the following family description of Platanaceae (Watson and Dallwitz, 1992), as an example for the remainder of the lab. This is a very thorough example and you are not expected to make yours as detailed.

**Platanaceae Dum.**

**Habit and leaf form.** Large trees; leptocaul. Mesophytic. Leaves deciduous; medium-sized, or large; alternate (sometimes to subopposite on vigorously growing shoots); spiral; flat; petiolate (the petiole base enclosing the axillary bud); sheathing (via the stipules); simple. Lamina nearly always dissected (merely toothed in *P. kerrii*); nearly always palmatifid; palmately veined (nearly always), or pinnately veined (*P. kerrii*); cross-venulate. **Leaves** **stipulate**. Stipules concrescent (around the stem); ochreate; scaly; caducous. Lamina margins dentate; flat. Vegetative buds scaly. Leaves without a persistent basal meristem. Domatia occurring in the family (8 species); manifested as pockets.

**Leaf anatomy.** Stomata more or less anomocytic.

*Lamina* isobilateral (but the abaxial palisade cells shorter). Minor leaf veins without phloem transfer cells.

**Stem anatomy.** Cork cambium present; initially superficial (the bark scaling off in large flakes, leaving the trunk smooth). Nodes multilacunar (7). Internal phloem absent. Secondary thickening developing from a conventional cambial ring. ‘Included’ phloem absent. Xylem with fibre tracheids; with vessels. Vessel end-walls scalariform and simple. Vessels without vestured pits. Wood parenchyma apotracheal (diffuse or in uniseriate bands). Sieve-tube plastids S-type.

**Reproductive type, pollination. Fertile flowers** **functionally male and functionally female**. Plants monoecious (the unisexual clusters in separate inflorescences). Female flowers with staminodes (commonly, 3–4), or without staminodes (?). Gynoecium of male flowers vestigial, or absent. Pollination anemophilous.

**Inflorescence, floral, fruit and seed morphology.** Flowers aggregated in ‘inflorescences’; in heads. **Inflorescences** **consisting of pendulous strings of up to 12 dense, globose, sessile or pedunculate heads of flowers, each infloresence exclusively either male or female**. Flowers bracteate, or ebracteate (depending on interpretation of the ‘scales’); small; regular; cyclic. Floral receptacle not markedly hollowed. Free hypanthium absent. Hypogynous disk absent.

***Perianth*** **with distinct calyx and corolla (or at least, so interpretable, in male flowers), or sepaline (the female flowers lacking any semblance of a corolla)**; 3–4(–7), or 6–8(–14); free, or joined; 1 whorled, or 2 whorled; isomerous; different in the two whorls. Calyx 3–4(–7) (not vascularized); 1 whorled; polysepalous, or gamosepalous (sometimes united basally); regular. Corolla in male flowers 3–4(–7) (tiny or vestigial); 1 whorled; polypetalous.

*Androecium* 3–4(–7). Androecial members free of the perianth; all equal; free of one another; 1 whorled. Androecium exclusively of fertile stamens. Stamens 3–4(–7); isomerous with the perianth; oppositisepalous; filantherous (the filaments very short), or with sessile anthers. **Anthers** basifixed, or adnate; non-versatile; dehiscing by longitudinal valves; latrorse; bilocular; tetrasporangiate; **appendaged (via the peltate connective)**. Microsporogenesis simultaneous. Tapetum probably glandular. Pollen grains aperturate; 3 aperturate, or 4 aperturate (rupate), or 6 aperturate; colpate (3-), or rugate (6-); 2-celled.

*Gynoecium* (3–)5–8(–9) carpelled. Carpels isomerous with the perianth, or increased in number relative to the perianth. **Gynoecium** **apocarpous**; eu-apocarpous (in 2–3 whorls); superior. Carpel incompletely closed (distally); non-stylate; apically stigmatic (the papillate stigma decurrent along the apical style); 1(–2) ovuled. Placentation apical to marginal. **Ovules** pendulous; **orthotropous**; bitegmic; crassinucellate.

*Fruit* non-fleshy; an aggregate. The fruiting carpel indehiscent; an achene, or nucular (with accrescent, pappose hairs from the base). **Gynoecia of adjoining flowers** **combining to form a multiple fruit**. Fruit 1 seeded. Seeds scantily endospermic. Endosperm oily. Embryo well differentiated. Cotyledons 2. Embryo straight (slender).

1. **Ranunculaceae—the buttercup family**

Using the following species, answer the questions below:

*Aquilegia canadensis Ranunculus abortivus*

*Anemone lancifolia Thalictrum dioicum*

* 1. Derive a general floral formula for the family.
  2. Write a description for the family. Include information about the overall habit, phyllotaxy, leaf description, inflorescence type, flower description (include sex, calyx, corolla, androecium, gynoecium, and any other features that might be diagnostic such as nectaries, staminodes, spurs, etc.) and fruit type, if available. If you have any questions, feel free to consult your TA.

1. **Berberidaceae—the barberry family**

Using the following species, answer the question below:

*Podophyllum peltatum Mahonia* sp.

*Nandina domestica*

* 1. Write a description for the family. Include information about the overall habit, phyllotaxy, leaf description, inflorescence type, flower description (include sex, calyx, corolla, androecium, gynoecium, and any other features that might be diagnostic such as nectaries, staminodes, spurs, etc.) and fruit type, if available.
  2. What characters do all of these species have in common?

1. **Papaveraceae—the poppy family**

Using the following species, answer the question below:

*Eschscholzia californica Stylophorum diphyllum*

* 1. Write a description for the family. Include information about the overall habit, phyllotaxy, leaf description, inflorescence type, flower description (include sex, calyx, corolla, androecium, gynoecium, and any other features that might be diagnostic such as nectaries, staminodes, spurs, etc.) and fruit type, if available. If you have any questions, feel free to consult your TA.
  2. What characters do all of these species have in common?

**Assigning Unknown Species to Families**

There are four unknown species (all live specimens) labeled 1-4. Name the family to which they each belong (from the four discussed today) and what character(s) you used to place them in that family.

1. Family:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Why this family?

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Why this family?

**References:**

Moore, M. J., P. S. Soltis, C. D. Bell, J. G. Burleigh and D. E. Soltis. 2010. Phylogenetic analysis of 83 plastid genes further resolves the early diversification of eudicots. *PNAS* 107(10):4623-4628.

‘Watson, L., and Dallwitz, M.J. 1992 onwards. The families of flowering plants: descriptions, illustrations, identification, and information retrieval. Version: 4th March 2011. <http://delta-intkey.com>.