

BPSC 031 “Spring Wildflowers”

Lab 9. Gymnosperms (Conifers and allies) and Pteridophytes (Ferns and allies)

I. Gymnosperms (Conifers and allies)

Gymnosperms (literally “naked seed”) are vascular plants that reproduce by means of an exposed ovule that, once fertilized, becomes an exposed seed. Unlike true flowering plants (angiosperms), whose ovules are sheltered inside closed ovaries, the ovules of gymnosperms are borne on open bracts, commonly arranged in **cones**, or “**strobili**.” The leaves of most gymnosperms have a relatively simple structure, with parallel venation and often with acicular (needle-like) shape.

In most gymnosperms the **male pollen cones**, or **micro-strobili**, contain small bracts that bear pollen sacs on their lower surfaces. The larger **female ovulate cones**, or **mega-strobili**, may be borne on the same plant that bears the male strobili (as in conifers) or on separate plants (as in cycads and Ginkgo). A female cone contains many bracts that shelter the ovules.

For pollination to take place, in many gymnosperms a sticky “pollination droplet” oozes from a tiny hole in the female cone bracts to catch pollen grains floating in the air. In other species, the pollen grain settles on the surface of the female cone from where it germinates, producing a pollen tube that grows into the bracts towards the ovule.

II. Pteridophytes (Ferns and fern allies)

The ferns and fern allies are vascular plants. Most of them have leaf-like structures (known as **fronds**), roots, and sometimes true stems, or even trunks as in the tree ferns. Most ferns show vascularized rachises (frond stems), pinnately or fractally-compound fronds, and **sori** (spore clusters) arranged along the underside of each frond segment. Although true ferns are always leafy, some fern allies such as the horsetails (*Equisetum arvense*) may have very reduced leaves and photosynthetic stems. There are also floating aquatic ferns such as the water fern (*Salvinia molesta*) and mosquito ferns (*Azolla* spp.).

Small to medium-sized ferns in California develop from a usually short underground rhizome. Fronds are divided into many small segments attached to a tough, often wiry, rachis. Spore clusters, called sori, develop along the underside of each frond segment. In most ferns, leaves grow from apical cells in the tip of the frond, and these delicate embryonic cells are protected by hairs or scales and by the curled-over spiral of the unrolling leaf tip, which gives fern fronds a typical spiral shape at their tip.

Leafy ferns reproduce by microscopic spores borne in spore sacs (**sporangia**) arranged into sori (brown patches) on the backside of the fronds. In some fern allies, such as the horsetails, the sporangia may be housed in terminal cone-like strobili at the tip of the stems. Each **sorus** consists of several to numerous tiny spore sacs. Microscopic brown or black spores are released from their spore sacs into the air where, because of their tiny size, they may float for long periods of time, allowing the wind to move them long distances into new habitats.

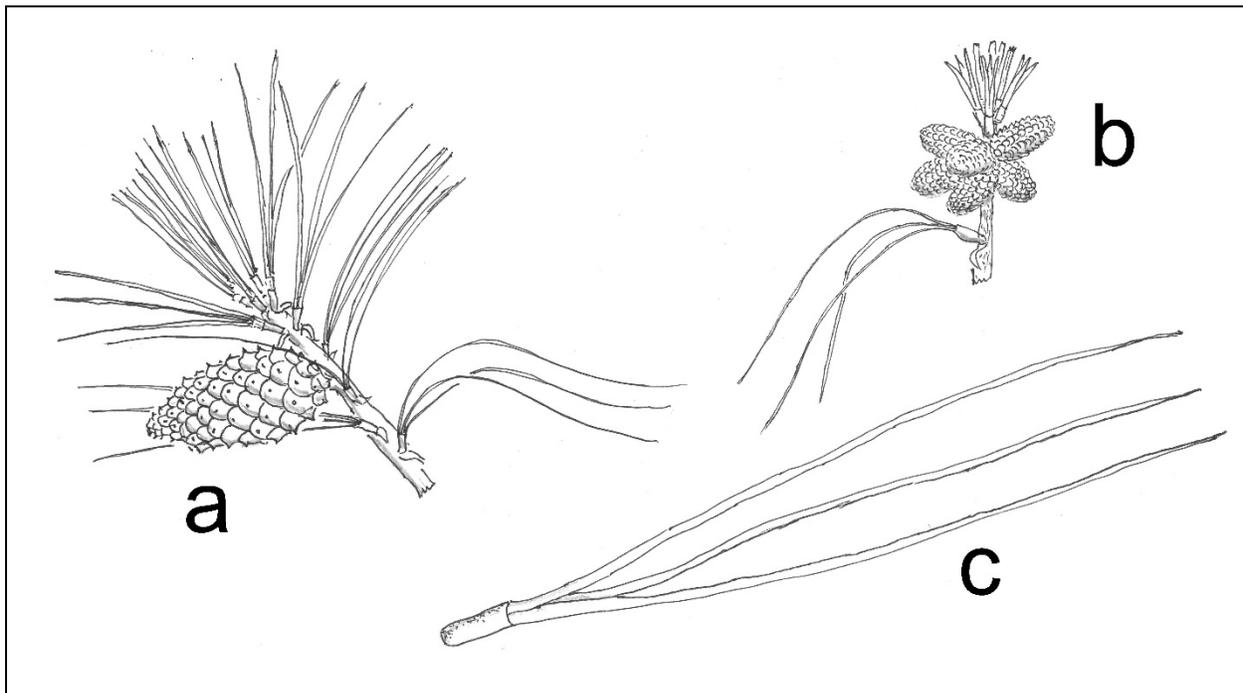
Take randomly one plant from each family in the lab and, according to the taxonomic group you have chosen, develop the following activities.

1. Gymnosperms (Conifers and allies)

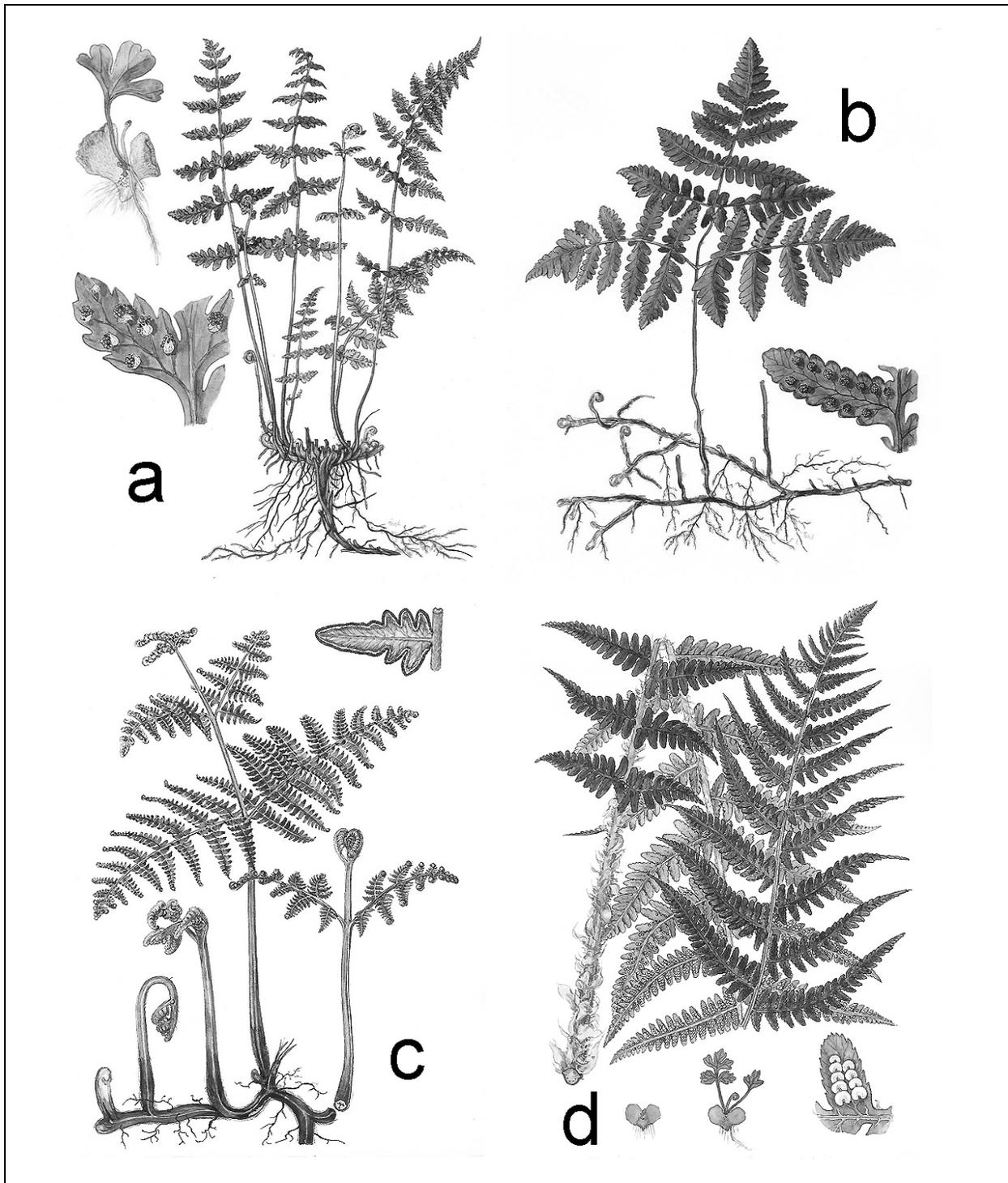
- Using the loupe, observe a male and a female cone (micro-strobilum and macro-strobilum, respectively). Compare their sizes and appearance.
- Using a scalpel or a sharp blade, dissect the cones with a longitudinal cut. Try to identify the ovules in the female cone, and the pollen sacs in the male cone.
- Extract an individual leaf from the stem that supports the cones. Describe the shape and venation type of the leaf.
- Make a sketch of the most distinctive traits you have observed in this plant(s).

2. Pteridophytes (Ferns and fern allies)

- Look at a fern frond and, with care, explore the spore-bearing sori in the underside of the leaf. Using the loupe, can you see the sporangia inside a ripe sorus?
- Observe the lack of modular growth in the fern fronds: Verify that there are no axillary buds along the frond's rachis.
- Search for a developing frond and observe the apical tip, protected by scales or hairs. Look in detail at the spirally-shaped development of the tip, typical of ferns.
- Make a sketch of the most distinctive traits you have observed in this plant(s).



Gymnosperms-at-a-glance: Trees with linear, often acicular leaves and reproductive structures in open bracts arranged along a shortened axis or cone: (a) Female cone branching from a shoot of ponderosa pine (*Pinus ponderosa*), (b) whorl of male cones near the apex of a shoot, and (c) acicular leaves, often called “pine-needles”, in whorls of 3 (or more in other pine species) supported by a basal sheath.



Ferns-at-a-glance: Vascular plants with leafy, pinnately or fractally-compound fronds, and sori (spore clusters) arranged along the underside of frond segments. True ferns in California develop from a usually short underground rhizome, from where the frond rachis grows. Depicted, four ferns from the California sierras: (a) Bladder fern *Cystopteris fragilis*, (b) oak-fern *Gymnocarpium dryopteris*, (c) braken *Pteridium aquilinum*, and (d) male-fern *Dryopteris filix-mas*.