# **Pollen Identification Lab**

#### **Objectives**

Practice using a microscope to see what pollen looks like, to observe the diversity of pollen morphology. Compare reference pollen from flowers with local pollen samples.

### **Topics Addressed**

Genetics of pollen, biodiversity

#### Background

Pollen is composed of pollen grains which are the male gamethophytes of (seed producing) plants (gymnosperms and angiosperms). This means that pollen grains produce the male gametes (sperm) and thus produce half of the genetic material required for seed development. Pollen grains are highly variable in size (from about 10 to nearly 100 micrometers), shape (oval, round, disc-shaped) and texture (smooth to spiky).

By determining the size, shape, number germination pores and their position, and the structure of the cell wall, it is sometimes possible to find out the species the pollen belongs to (most of the time though, only the plant family can be determined). Because of this, paleontologists are able to determine plant species composition of ancient forests based on pollen grains deposited in sediment layers. By analyzing pollen from well-dated sediment cores, scientists can obtain records of changes in vegetation going back hundreds of thousands, and even millions of years (NOAA ).

It is also possible to determine which plants (or at least how many different ones) a pollinator has visited by examining the pollen attached to its body. This can help answer important ecological questions, like how far pollinators travel (for example, if the pollen found is from a plant that grows only far away from where the pollinator was captured) or determine the 'fidelity' or 'promiscuity' of the pollinator (does it visit few or many species of plants during the day?).

Background Question: What are the advantages and disadvantages of each type of pollination?

#### Materials

- Compound microscopes with a 10-x ocular and 40x objective are necessary to make out differences in pollen grains.
- Slides and cover slips for preparing pollen samples.
- Pen for marking slides

#### Preparation

Prior to conducting lab with students, teachers should collect and prepare reference pollen samples. For sampling in the field, you can collect pollen from the anthers of flowers (using a small brush, gently touch the antlers and then dip the brush in a vial with alcohol. Label the vial with the plant species. Repeat for different plant species (clean the brush every time!). Then compare the shape and size of different species)

You may also choose to have students help you prepare the slides for the reference slides and/or the honey slides, as described below. To keep it simple, you might decide to only have students working at microscope stations to looks at slides and detect differences between types of pollen. Try sampling from different vials and try to get pollen from as many different plant families as possible. Excellent choices include: rose, carrot, dandelion, sunflower, grass, orchid, milkweed, rhododendron, evening primrose, buttercup, and mint.

**Even more fun:** collect pollinators, put them in vials in alcohol. In the lab, use a brush to gently get all the pollen out. Students could do pollen counts (# grains per square mm or cm), pollen diversity (how many different types of pollen grains). Students could even compare pollen counts of pollen diversity of different pollinators (e.g. honeybees vs bumblebees; bees vs flies)

#### **Day 1: Slide Preparation**

- 1. Each student should gather a clean microscope slide and marking pen.
- 2. Go outside and locate a flower that is pollinated by bees. Excellent choices include rose, carrot, dandelion, sunflower, grass, orchid, milkweed, rhododendron, evening primrose, buttercup, and mint, but many other flowers will work.
- 3. Using the pen, mark your initials, the date, and the flower species on the side of your slide.
- 4. Carefully remove one of the anthers from the flower, and dust it on the glass slide. Pollen should be visible on the slide when you are done.
- 5. Bring the slide back to the classroom, place a drop of water on the pollen, then cover with a cover slip.
- 6. Observe and sketch the pollen under the microscope. You will need to focus on the pollen grains at 400X in order to see significant difference in appearance. Use the data sheet to sketch and describe the magnified pollen. Note: It is possible to use a cell phone camera to take a picture of the pollen to assist with drawing and further magnify the image.
- 7. Use classmates' slides to observe and sketch different kinds of pollen, for a total of 6 different types.

#### **Day 2: Pollen Identification**

On Day 2 students will observe unknown pollen samples and try to identify the pollen using the reference slides from Day 1.

- 1. Obtain one of the prepared slides containing unidentified pollen collected from a bee.
- 2. Using the microscope, observe and sketch the pollen sample at 400X magnification.
- 3. Attempt to identify the pollen sample using your reference pictures from last class. If the pollen grain you are looking at does not match one of your samples from Day 1, use classmates' drawings to find a species that matches your sample.

### **Analysis Questions:**

1. What differences were visible when looking at pollen under the microscope?

2. Why do different plants have different pollen shapes?

3. What is the advantage of having insects transfer pollen, rather than allowing it to be carried by the wind?

4. What would happen if the pollen was not transferred between flowers by bees? Why would that be a problem?

5. Why is having pollinators besides honeybees (bumblebees, sweat bees, mason bees, etc) important to the plants in this area?

# Day 1 Pollen Slides



#### **Day 2 Unknown Pollen Samples**



### **Teacher Notes for Pollen Identification Lab**

#### Approximate time: Two class periods

- This lab can be completed as a one day activity. Rather than have students collect the plant samples, the instructor can collect 5-10 different labeled pollen samples and put them on slides before class to use as the reference slides.
- When making the pollen slides, you may want to use a dye, rather than water, to help make the pollen more visible. Calberla's solution works well. Calberla's solution may be purchased or made: 5 ml glycerol 10 ml 95% ethanol 15 ml distilled water 2 drops saturated, aqueous solution of basic fuchsin. To see the pollen properly, they should be stained a light pink and not a dark red. It may be necessary to adjust the fuchsin concentration.
- There are several ways to collect pollen for your unknowns. Probably the best way for this lab is to capture several bees and transfer the pollen carried on their back legs to a microscope slide.
  Honeybees and bumblebees in particular usually have larger corbiculae (pollen baskets) that contain a lot of pollen. Several slides can be made from one bee.
- Alternatively, you may just want to collect pollen directly from several flowers for use as unknowns, but this method doesn't give as much information about which types of pollen are actually being moved by the local bees.