

# Flower Power: Pondering Pollination

## Grade 4

### Supplies

- Hand lenses
- Paper
- Colored pencils
- Clipboards
- Color chart
- Binoculars

### Background information

Before flowering plants can produce seeds, they must be pollinated. Some flowering plants are pollinated by the wind, but most are pollinated by animals - generally insects - and close relationships have often evolved between each plant species and its pollinators. Some flowers are pollinated by a variety of different animals but for some highly specialized flowers rely on a single species of animal for reproduction. In California, many species of insects - including bees, beetles, butterflies, and moths - and birds – for instance, hummingbirds – are important in pollination of native plant species.

The shapes, colors, and patterns of flowers, as well as their fragrance and the type and amount of nectar produced, are all important in attracting pollinators. Different pollinators are attracted to different colors. For example, bees can see patterns of ultra-violet, a color that humans cannot see at all, and visit many flowers that may look plain to us. Bees cannot see red so they tend not to visit red flowers. Hummingbirds use this to their advantage, visiting red flowers first to avoid being hassled by bees.

Flowers that attract day-flying pollinators are open on bright sunny days and closed in dim light – for instance, California poppy – while others that attract night-flying pollinators may open at dusk and close in bright light – such as evening primrose.

### Examples of Plants and their Pollinators

*hummingbird sage, scarlet bugler penstemon*

Hummingbirds are active during the day. They prefer tubular flowers, or flowers with throats or spurs that contain abundant nectar that only they can reach. In general, birds have excellent eyesight and hover or perch while visiting flowers. They are attracted to red tubular flowers with abundant nectar, as bees can't see red, and can't reach the nectar at the end of the long tubes. Bird-pollinated flowers usually lack scent.

*evening primrose, jimson weed*

Moths, especially hawk moths, are important pollinators. They emerge at dusk, and are attracted by large, pale colored (white or pale yellow) flowers with tubular throats that also open at dusk. Moth-pollinated flowers often produce a strong, sweet scent in the evening. Flowers that attract moths are often closed during the day only, opening at dusk, and closing as the sun rises. Hawk moth pollinated flowers generally produce abundant nectar. These moths fly and hover rapidly (like hummingbirds) and therefore need a great deal of energy.

*verbena, milkweed*

Butterflies have excellent senses of smell and taste. They sense through their tongues, antennae, and feet. Their long tongues uncoil to reach hidden nectar. Butterfly pollinated flowers are usually scented, large, and showy, and have a 'landing platform', as unlike hummingbirds and hawk moths, butterflies need to land to eat. Individual flowers often have deep throats and may be clustered into flat heads, creating a perch. Butterflies can see colors in the ultra-violet range. Butterfly pollinated flowers are often blue, lavender, deep pink, or orange-red and generally have nectar guides, lines that show the butterflies where to find the nectar.

*Salvias, California poppy, Manzanita*

Bees cannot see red, but they can see colors in the ultra-violet range, invisible to humans. Bee pollinated flowers appear to humans as blue, purple, yellow, or white, or in a combination of these colors. They may also have nectar guides (often in ultra-violet, so they are invisible to us ) that guide bees to the nectar. The flowers may be showy and bowl shaped, or they may be bilaterally symmetrical (like a mirror image; bean flowers are a good example of this). Bee pollinated flowers usually, but not always, have areas that serve as landing platforms. Some flowers can be 'buzz pollinated' – bumblebees have to vibrate the stamens to release the pollen. Examples include tomatoes, peppers, and blueberries. Manzanita, a California native, is also buzz pollinated.

*Santa Cruz Island ironwood, other plants with small white flowers*

Some species of flies – especially bee flies and hover flies – visit flowers to feed on their nectar and pollen. Flowers that are pollinated by these insects usually do not have a scent and are often purple, blue, or white, although they may visit flowers of other colors. Some species of flies visit flowers that smell like rotting meat.

*oak, willow, meadow rue*

Wind pollinated flowers are different in appearance from those that attract animal pollinators. They are often small and green and lack showy colors. They may lack petals and are often clustered together in a dangling catkin-like arrangement. These flowers produce large quantities of pollen and have large, feathery stigmas that catch pollen. Wind pollinated plants are often tall and grow in masses. Some wind pollinated plants, such as willow, also attract insect pollinators that feed on their pollen; and in the case of willows, nectar too.

Lizards, bats, and other animals can also pollinate some plants, but are not discussed here.

### **Activity: Find some Flowers**

Explore your school yard, or a nearby natural area, and find different flowers in bloom. Ask students to draw each flower's shape, and interesting patterns, and note its color. Try to find an example of each

- Round cup-shaped flowers that are yellow or orange
  - California poppy
  - bush poppy
- Relatively large long-shed or tubular flowers that are red or bright pink
  - hummingbird sage
  - California fuchsia
  - columbine

- penstemon
- Small tubular two-lipped blue or purple flowers in whorls or 'button-like arrangements'
  - *Salvia* (sage)
- Light colored flowers that are closed in bright sunlight but open toward dusk or on a cloudy day
  - evening primrose
  - jimson weed
- Greenish, often dangling and clustered small flowers that lack petals and produce large amounts of pollen
  - oak
  - willow
  - meadow rue
  - Grasses, sedges, rushes

Ask students what they think might pollinate each type of plant? If it's a sunny day, try to spot pollinators visiting the flowers. Use binoculars to view flowers from far away and you might see a hummingbird. What color do the following pollinators seem to be most attracted to?

- Bees
- Hummingbirds
- Butterflies
- Moths
- Beetles
- None (wind pollinated)

### **Composite Flowers**

Members of the sunflower, or aster family, are also known as *composites*. Look closely at any 'daisy' and you will discover they are really a cluster of individual flowers. The flowers in the middle are 'disc' flowers, while each petal is a 'ray' flower. Native examples include seaside daisy, common aster, sunflowers, and goldenrod. Explore them close-up by pulling apart flower heads and examine both individual disc and ray flowers under a microscope or with a hand lens.

Many sunflower family members have heads of concentric rings of flowers that mature in sequence. The adaptive value of this feature is that it increases the length of time that flowers are receptive to pollinators. Can you see the rings of flowers with extended stigmas that are ready to be pollinated?

### **At the Santa Barbara Botanic Garden**

Search for the flowers listed above. What different flowers do you see here than at your school? Do you see more or fewer pollinators visiting the flowers here? Why might that be? California native plants are uniquely adapted to thrive in their natural habitat. This means that many flowers evolved here, and are more successful at attracting pollinators who are also native. Having a diversity of plant species also helps support your local ecosystem.

### **After your visit**

Using colored modeling clay, ask students make models of different flowers that would attract different types of pollinators.

Plant a native plant in your school and make ongoing observations of pollinators in action. Many native plants that attract pollinators can be purchased at the Garden Grower's Nursery. If students are interested, there are also plant lists for planting their own pollinator garden at home!

See **Leafing Through** for information on leaf form and function.

See **Fun with Flowers** for information on flower parts