

Pollination

Standards Addressed

Science Standards:

- A. Science Connections: A.4.1, A.4.2, A.4.3, and A.4.4.
- B. Science Inquiry: C.4.1, C.4.2, C.4.4, C.4.5, C.4.6, C.4.7, and C.4.8.
- C. Life and Environmental Science:
Life Cycles of Organisms: F.4.3.
Organisms and Their Environment: F.4.4.
- D. Science in Social and Personal Perspectives: H.4.1 and 4.2.

Environmental Education Standards:

- A. Questioning and Analysis: A.4.1, A.4.2, A.4.3, and A.4.4.
- B. Knowledge of Environmental Processes and Systems:
Energy and Ecosystems: B.4.1, B.4.3, B.4.4, and B.4.6.

Key Concepts/ Content

- ✿✿ To explore the importance of pollination of plants.
- ✿✿ To compare and contrast pollination of flowering and non-flowering plants by organic means such as insects, and inorganic means such as wind.
- ✿✿ To see how organisms within the same ecosystem interact.
- ✿✿ To develop explanations as to why some insects are better than others when pollination occurs.
- ✿✿ To seek out information to explain the necessity of pollination in the life cycle of a plant and its reproduction.

Background Information: Tree Pollination in Wisconsin

Pollination in Wisconsin forest trees generally takes place in the spring time during May and early June. In Wisconsin, forest trees are wind pollinated. This means the wind carries the pollen grain from one tree to the flower on another tree.

The pollen is usually white to yellowish in color and in some conifer species can be seen on dry windy days in late May as a yellow cloud. Also, after a spring rain, you can see yellow rings around the rain puddles; this is pollen.

Pollination takes place for most species over a short period of time, usually a week. However, production of viable seed varies immensely from species to species. For example, silver maple and American elm pollination occurs in early May and seed is mature by early June of the same year. In white oak, sugar maple, and white spruce, pollination generally occurs in May and seed is mature in September of the same year. Whereas, for red pine, white pine, and red oak, pollination occurs in May of year one, but the seed doesn't reach maturity until September of the following year, 16 months following pollination.

Trees have several barriers to prevent inbreeding or self-pollination. Inbreeding results in deleterious genes being expressed in the offspring and usually results in stunted, poorly adapted trees. The first barrier is isolation: the male catkins that produce the pollen are generally located on the bottom portion of the tree and the female flowers are located near the top of the tree. The second barrier is pollen competition, where the female flower chemically limits related pollen from fertilizing the female gamete.

The Wisconsin DNR Tree Improvement Program uses controlled pollination to improve growth rates, disease resistance, and form for the major forest trees in Wisconsin. This is accomplished by selecting individual trees that exhibit the desired characteristics through genetic tests. Then, on the selected trees, the female flowers are isolated prior to their being receptive with a physical barrier called a pollination bag. This keeps unwanted or unknown pollen from fertilizing the flower. Next, pollen is collected from another desirable tree and extracted from the catkins in the laboratory. The selected pollen is then inserted into the pollination bag by using a hypodermic needle to fertilize the female flowers. After the pollination period ends, usually in a week or two, the pollination bag is removed from the female flowers. The branch where the controlled pollination occurred is marked,

and when the seed matures, it is then harvested for future testing.

Seeds from the improved trees are used in Wisconsin's state forest nurseries to produce reforestation and conservation nursery stock. The three state nurseries are located in Boscobel, Wisconsin Rapids, and Hayward. They produce around 18.5 million seedlings per year to sell to landowners in Wisconsin for reforestation.

This activity deals with the pollination of plants. It is important to ask the students to relate the concepts they have learned about the pollination of forest trees and their understanding of the similarities and the differences in pollination techniques.

Getting Ready

- Students should be aware of the life cycle of plants and trees. Discussion and examples of annuals and perennials as well as flowering and non-flowering plants should be done in the classroom setting.
- Diagrams should be made available to students through texts, posters, and internet resources of plant and tree reproduction.
- If possible, students should observe insects pollinating plants in an outdoor setting, taking note of the kinds of insects seen, and what they are doing.
- Since students will be using the bodies of real insects for this activity, time needs to be set aside for the collection of insects. No living insects will be used in this activity. Students should understand that an insect can be killed painlessly by placing it in a container in the freezer overnight.
- Plants will be needed for this activity, too. Pea plants will work well. Using "fast plants" as indicated in the *Wisconsin Fast Plants* activities saves time and helps accelerate this activity.

Safety Issues



- ◆ When collecting insect specimens, students need to be careful of stings and bites. They should also be reminded

to respect the rights of property owners and to not destroy any plants in the process.

- ◆ Glass containers should not be used to collect insects if possible. Also, parents should be made aware of the activity so they may help supervise the collection of the insects.

Materials Needed

- ✦ Books, posters, and internet sites as explained above and listed in the resources for this activity
- ✦ Seeds, soil, and containers (enough for each group to have 3 plants)
- ✦ Water and watering containers
- ✦ Insect bodies (a variety including bees and beetles to be shared)
- ✦ Straws, toothpicks, or popsicle sticks
- ✦ Glue
- ✦ Pencils and rulers
- ✦ Journaling pages

Procedures

1. Ask the students to plant their seeds for this activity 1 or 2 weeks prior to the beginning of this activity.
2. Begin collecting insect bodies—1 per student.
3. Discuss plant reproduction, life cycles, and pollination during this time (including forest tree pollination).
4. Prepare insects by allowing the bodies to dry out naturally. (Do not place them in covered or closed containers.) Glue or fasten each insect to the end of a stick so the bulk of the body is glue free.
5. Place students in cooperative groups of 2 or 3.
6. When the (pea) plants have bloomed, it is time to perform the activity.
 - A. Remove all the blossoms of one of the plants.
 - B. Try to blow the pollen from one blossom to another or

set the plant outside and allow the wind to blow over it naturally.

C. Using the sticks with insects mounted, simulate pollination by moving them from blossom to blossom collecting, if possible, pollen on the bodies of the insects. (Not all groups will be using the same kind of insect. Do not use more than one kind of insect for each individual plant.)

7. Allow the plants to grow and observe which plants and blossoms produce fruit (peas).

8. Record and discuss data.

**Evidence of
Student
Understanding**

- Through observation and the collecting of data, students should learn that flowering plants must have a blossom to produce fruit. They should also learn that wind is not the only means for pollination of flowering plants. In addition, the activity should produce results that indicate to the students that bees are an excellent means of pollination, but beetles and other insects with a hard exoskeleton do not collect and deliver the pollen as easily, and therefore do not pollinate as well as bees.
- Students should be able to explain this information from data collected and written in their journals.
- Students may also raise further questions for additional study, question the findings of another group, or explain findings contrary to the expected outcomes.
- Ask the student to relate this information to the pollination of forest trees.

Extensions

- You may choose to vary the types of plants used in the activity, but keep all the plants the same for each group so the variables will remain the same.
- You may choose to set a plant aside to see if it will self-pollinate.
- Recording and graphing the rate of growth of your plants and the peas they produce will allow for the students to have a visual record of what happened during the weeks spent on the activity.
- You may choose to compare types of seeds, “fast plants” vs. regular plant seeds; however, if you do, you may need to start the activity earlier with some groups since blossoms will be produced somewhat earlier.
- You may choose to cross-pollinate several plants. For example, two groups using bees may carry the pollen from their plant to the other group’s plant.

References/ Resources

 www.fastplants.cals.wisc.edu

 www.netspace.org/MendelWeb/MWflower.html

 www.whfreeman.com/life4gif/ch34/3405.gif