Pollination: Pecan Production

Time required:

45 minutes

Lesson Objectives:

- The students will be able to identify different types of pollination and differentiate between wind- and insect-pollinated flowers
- Educate students on plant reproduction.

Video Links:

The video links below are a great way to introduce pollination. Students will discover that plants are pollinated in many ways. Students will also become familiar with the differences between plants that rely on animals, such as insects and mammals, to reproduce and plants that rely on wind or water. You may choose to play some or all the videos for your students as time allows (teacher's discretion).

1. You Tube video: "Pollination and Its Types" (self and cross pollination animated video). 4:13. Important vocabulary and explanation. https://www.youtube.com/watch?v=hUBi5decM4o
2. YouTube video: "Pollination by Wind." 2:08. More in-depth explanation of wind pollination. Attributes of animal pollinated flowers and wind-pollinated flowers. https://www.youtube.com/watch?v=MJvbuPBe2cg

Supplemental Videos:

3. You Tube video: "Wind Pollination." 1:01. University of Wyoming Extension Service. https://www.youtube.com/watch?v=Z9khrbZD87Q
4. You Tube video: "Vitamin Bee: Pollination." 1:53. Animated video demonstrating how bees assist with pollination (transfer of pollen). https://www.youtube.com/watch?v=uDJpk89_Y8s

Materials Needed:

- Wind Versus Insect Pollination worksheet
- Video links
- Parts of the Flower diagram (optional)

Introduction:

Plant Reproduction Overview

Reproduction in flowering plants begins with pollination. Pollination is the process by which pollen grains are transferred from the stamens (the male parts of a plant) to the pistil (the female structure). In flowering plants, the **pistil** typically consists of a swollen base called the **ovary,** which contains the potential seeds, or **ovules,** and a stalk with a pollen-receptive tip called the **stigma**. When a pollen

grain is deposited on the stigma, it forms a pollen tube that grows down through the pistil and into the ovules. Fertilization occurs when a sperm cell in the tube fuses with the egg cell of the ovule. The ovule then develops into a seed. In contrast, in plants such as conifers the ovules are exposed. The pollen is simply caught in a drop of fluid secreted by the ovule. Some plants have flowers with both stamens and pistils and are capable of **self-pollination**; they can fertilize themselves. Other plants are unisexual; their flowers bear either stamens or pistils, but not both. These plants achieve fertilization by **cross-pollinating** with other plants. They commonly rely on external agents, such as insects, birds, some mammals, wind, or water, for pollen transport. These external agents are referred to as **pollinators**.

Methods of Pollination

About 80% of all flowering plants and over three-quarters of the staple crop plants that feed humankind rely on **animal pollinators**. This includes insects like bees, moths, and butterflies or birds and small mammals like bats. Pollinators visit flowers in search of food, mates, shelter, and nest-building materials. Animal pollinators play a crucial role in flowering plant reproduction and in the production of most fruits and vegetables. The flowers of animal-pollinated plants can attract animals in various ways, like having large, brightly colored flowers or by producing nectar or sweet scents. In general, pollination by animals occurs after they reach inside the flowers for nectar. While feeding on the nectar, the animal rubs or touches the stamens and is covered in pollen. Some of this pollen will be deposited on the stigma of the next flower it visits, pollinating the flower. In insect-pollinated flowers, the produced pollen grains are larger in size, sticky and spiny, which helps the insect to carry the pollen grains.

About 12% of the world's flowering plants are **wind-pollinated**, including grasses, cereal crops and many trees, including pecan trees. Wind-pollinated plants often look very different than animal-pollinated plants. Their flowers either have no petals or smaller petals that are often brown or dull green. They have no need to create nectar or a sweet scent to attract a pollinator. The stamens and stigmas are exposed to air currents. In wind-pollinated flowers, the produced pollen grains are smaller and lighter in weight, which can be carried by the wind easily. Wind pollination is much less precise than animal pollination; therefore, wind-pollinated plants produce a large amount of pollen.

Water-pollinated plants are aquatic. Pollen floats on the water's surface, drifting until it contacts flowers. This is called surface hydrophily but is relatively rare (only 2% of pollination is hydrophily). This water-aided pollination occurs in water weeds and pond weeds.

Engagement:

- Ask students, "What are your favorite flowers?" "Do you know what purpose the flower of a plant serves?"
- Ask students, "Do all flowers look the same?" Let students answer and say, "Why do you think flowers look different?"

Vocabulary Words

Pollination: The process by which plants reproduce. It involves moving **pollen grains** from the male **anther** of a flower to the female **stigma**. This is done in several ways with the assistance of pollinators. **Pollinators** include wind, water, and animals such as insects, birds, mammals, etc.

Self-pollination occurs when the pollen from the anther is deposited on the stigma of the same flower or another flower on the same plant. **Cross-pollination** is the transfer of pollen from the anther of one flower to the stigma of another flower on a different plant of the same species. Example: Pecan trees are **allogamous**, meaning that they cross-pollinate.

Pollen grains: Individual cells that contain the male DNA of a plant. Pollen is light and sticky, allowing it to be transferred by the animals that encounter it or by wind or water.

The **stamen** is the male reproductive part of the flower. It consists of two parts, the **anther** and the **filament.** The stamen is responsible for making and releasing pollen.

The **pistil** is the female part of the flower that captures the pollen and grows the seed. It consists of three parts, the **stigma** (collects pollen), **style** (pathway for pollen grain), and **ovary** (holds the growing seed).

Pecan trees are **monoecious**, which means both the male and female flowers are on the same tree. The female flower is called **pistillate,** and the male flower is called **catkin**.

Activity

Pollination Worksheet: Wind vs. Insect

1. Create a Venn diagram or a T-chart using the phrases bank provided. Sort the information into categories. Compare and contrast wind- and insect-pollinated flowers.
2. Hands-on activity suggested for students engaged in remote learning. YouTube video: "At Home Activity on Wind Pollination." https://www.youtube.com/watch?v=NyxpI0lTLRQ

References

1. http://www.bbc.co.uk/bitesize/standard/biology/world_of_plants/growing_plants/revision/4/
2. https://www.noble.org/news/publications/ag-news-and-views/2016/june/cross-pollination-is- essential/#:~:text=Pollination%20in%20the%20pecan%20orchard,not%20required%20to%20complete%20pollination.
3. https://kids.britannica.com/students/article/pollination/276490

Louisiana Standards Covered in This Lesson

2-LS2-2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

3-LS1-1 Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-ESS2-3 Ask questions that can be investigated and predict reasonable outcomes about how living things affect the physical characteristics of their environment.

6-MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

6-MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

6-MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

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MISC 364D (Online Only) 3/21
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