CANADIAN WILDLIFE FEDERATION

15-60 minutes

Pollination Lesson Plan

Students discuss the different types of pollination, what attracts pollinators to plants, and why pollination is important. They then design a comic strip to illustrate and explain the process of pollination.

LEARNING OBJECTIVES

Students will:

- ☐ Understand the basics of plant reproduction and why this generates a need for pollinators
- ☐ Understand the overall process of pollination including the history of pollination and why this process is important to nature
- ☐ Understand key aspects of pollination (abiotic/biotic) (self-pollination/cross pollination)

MATERIALS

- Coloured pencils, markers, or other drawing materials
- Paper
- Resources: An Overview of Plants.pptx, The Science of Pollination Primer

IN ADVANCE

Ask students to read the background information (below) and other resources (listed above in the Materials section).

ACTIVITY

1. Introduce students to the concepts of pollination and plant reproduction.
    - If you did not assign reading in advance, explore the background information (below) and other resources (listed above) with the class.
2. Generate a discussion about pollination.
    - Ask the students a question like: “Why do plants reproduce?”
    - Emphasize that the process of pollination would not exist if plants did not reproduce.
3. Ask the students to imagine that they have to explain pollination to a friend who doesn’t know anything about this amazing process. To do this, each student will:
    - Choose a pollinator to feature.
    - Choose a plant with flowers the pollinator would pollinate.

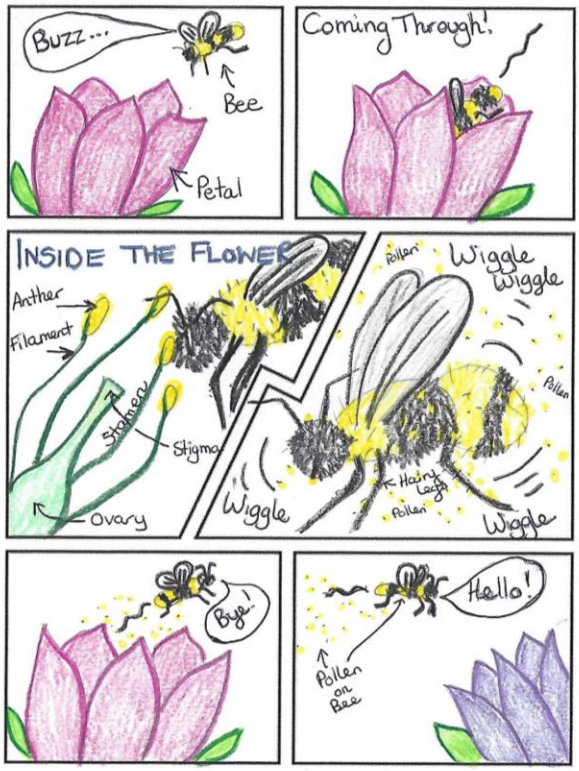
- Design a comic strip to illustrate the concepts of pollination and plant reproduction (featuring their chosen pollinator and plant).

    i. A comic strip format allows students to make use of images and a few key words to explain pollination to their friend, step by step.
    ii. Students can refer to the resources and related media linked to this activity, (supplemented by their own research if necessary).

4. Students should try to label the parts of the pollinator and flower that make pollination possible. For example:

    - If they chose a bee, they may want to point out its hairy legs.
    - For the flower, they might point out structures like the anthers (structures with pollen) and the style (tube that leads to the flower's seeds).

5. Encourage students to be as creative as they like. They can draw, paint, use a computer program, cut out images, use sidewalk chalk – anything goes (with your approval)!



Use the resources and related materials provided with this lesson plan to help them get started. You can also encourage students to do their own research.

Background

The ability for plants to successfully reproduce was necessary as plants transitioned from an aquatic environment to the land. Once plants were established on land, the rise of reproduction and pollinators allowed plants to flourish and colonize the land.

To transition the discussion to pollination it is important to talk about the early land plants and a few major changes that occurred prior to the need for pollination.

The Rise of Pollination

The first plants that inhabited the earth did not produce seeds during reproduction. The earliest forms of plant life (ferns, mosses, liverworts) produced male and female spores which could be dispersed into the environment by different vectors including water and wind. The male spores had a tail (flagella) structure, that provided the ability to swim. The male and female spores could interact and undergo fertilization to form a new plant.

This process was not advantageous because there was a huge dependence on water for successful reproduction. Since the terrestrial environment can be dry, plants needed a better mechanism to ensure successful reproduction.

To improve the success of plant reproduction in early land plants, two important events occurred.

1. Plants evolved to produce pollen. The pollen is similar to the male spore, with the major difference being that a pollen can survive without water. The pollen grain was protected from the environment and could persist for long periods of time without water.
    - One major advantage of pollen was the ability for pollen to travel large distances to fertilize the female gamete. This was a key requirement for the beginning of pollination.
2. The second major event to improve the success of reproduction was the production of seeds. According to fossil records, the first plants to form seeds were ferns. The seed-bearing ferns date close to 390 million years old. Following reproduction, a mature seed would form on a plant. This seed could be dispersed into the environment, where a new plant would eventually grow.
    - The major advantage that a seed possessed was the ability to remain dormant in a dry environment. When the conditions were favourable for growth (water, sunlight, temperature), the seed could germinate and grow into a new plant.

With these two major changes occurring in plants, the need for pollination was at the forefront. To introduce the topic of pollination, ask the students to identify some problems that plants may have during reproduction.

Plants need to reproduce in order to ensure the survival of their species for future generations. During reproduction, plants are able to pass on their genetic information to their offspring. It is important to understand that reproduction in plants can occur in a number of different ways.

The two major forms of reproduction in plants are asexual reproduction and sexual reproduction.

1. **Asexual Reproduction –** a method of reproduction for plants to reproduce without the need to invest energy into the development of reproductive organs and gametes.

Two types of asexual reproduction in plants are vegetative and apomixis:

A. Vegetative reproduction:

- During **vegetative reproduction**, plant parts, including stems and roots, can form new offspring which are identical clones of the parent plant. Some examples of plants that reproduce this way are ginger, potatoes, and strawberries.
- A major advantage of vegetative reproduction is that the process can happen quickly and does not rely on processes including pollination.
- A major disadvantage with vegetative reproduction is the lack of genetic diversity within a population.

B. Apomixis reproduction:

- During **apomixis reproduction**, a plant is able to produce a seed without fertilization occurring. One example of a native plant species that can undergo apomixis is the dandelion.
- During apomixis, there is no pollen that fertilizes the egg cell to produce a seed.
- This method of reproduction is very uncommon in nature.

2. Sexual reproduction – a method of reproduction where the male gamete (sperm cell contained within the pollen) fertilizes the female gamete (egg contained within the ovary) to produce new seeds.

- During **seed reproduction**, there is a transfer of pollen grains from the male reproductive structure (anther) to the female reproductive structure (stigma). Once the pollen has landed on the stigma, the pollen grain will absorb water and produce a pollen tube that will transport the gamete cells (sperm) down the female reproductive structure into the ovary. When the pollen tube finds the ovule (egg) inside the ovary, the male gamete cell will fertilize the ovule to produce an embryo, which is the new plant contained within a seed.

Pollination

The process of pollination will specifically focus on the transfer of pollen from the male to the female reproductive parts. There are two major types of pollination that can occur: abiotic and biotic.

- **Abiotic Pollination** – This pollination process is facilitated by non-living vectors which include wind, water, and gravity. Abiotic pollination was believed to be the first type of pollination that occurred in nature. The first instance of abiotic pollination (wind) documented in the fossil record was fern-like plants dating back to the Carboniferous period nearly 298-359 million years ago. It is predicted that approximately 20 per cent of the present-day species utilize abiotic pollination, with the majority utilizing wind pollination (98 per cent).

    - Wind pollinated plants - wheat, rice, corn, barley, oats
    - Water/rain pollinated plants - lotus, water lily

- **Biotic Pollination** – This pollination process is facilitated by living organisms (pollinators) which can include various mammals, insects, birds and humans. Biotic pollination, like abiotic pollination, is a process that originated millions of years ago. Scientists recently discovered a fossilized flower beetle with traces of pollen in a piece of amber. Scientists determined the age of this particular fossil to be 99 million years old, indicating the importance of pollinators in prehistoric times when dinosaurs roamed the earth.

Biotic pollination is an interesting process due to the important relationship that forms between the plant and the pollinator. The plant supplies the pollinator with a source of nutrition and the pollinator provides transportation for pollen to promote seed reproduction. Pollinators play an important role in promoting **cross-pollination** between plants. Cross pollination is important to promote genetic diversity amongst plants. It is also interesting to note that some plants (**self-pollinators**) are not dependent on pollinators. These plants are able to self-pollinate themselves. Many plants in nature have flowers which contain both male and female reproductive structures. Many of these plants are able to transfer pollen from the male reproductive structure to the female reproductive structure without the need for a pollinator to physically transfer the pollen. A few examples of self-pollinators include tomatoes, canola, and wheat.

Pollination summary

Pollinators work their magic as they travel from flower to flower, drinking nectar and gathering pollen that they, or their young, will eat. They are attracted to nectar and pollen-rich plants because of the bright colours and the sweet scents of the flowers. The yellow powdery pollen from these flowers sticks to their bodies.

When pollen is moved from one plant to another of the same kind, the pollen fertilizes the egg in the flower. This produces seeds that can turn into baby plants.

There are a few plants that do not need to be pollinated at all. Others can produce fertile seeds without pollination, but most plants ***do*** need to be pollinated to survive. Some plants are pollinated by the wind or water, but most plants are pollinated by animals called pollinators. Bees are the most efficient pollinators. Other pollinators in Canada include certain kinds of butterflies, moths, flies, beetles, wasps, and hummingbirds. In other parts of the world, mammals like bats are also pollinators. Pollinators are tiny creatures with a very important job to do!

DISCUSSION

1. Why do plants have flowers?
    - Flowers are important for producing seeds, which humans and animals can use for a number of different reasons including food.

2. What are your favourite flowers and why?
    - Flowers are important structures for the production of seeds and fruits. Animals and humans rely on flowers and plant reproduction for sustainable food sources.
    - Smell and colour are great answers (pollinators are attracted to these features).

3. What are pollinators? Can you give an example of a pollinator?
    - Pollinators are organisms that help move pollen between plants to help promote reproduction of plants.

4. Why are pollinators attracted to flowers?
    - Smell, colour, design and shape of flowers, nectar

5. Do all plants need pollinators?
    - This should make for an interesting discussion. The answer is no. While many plants rely on pollinators, many plants can spread pollen using non-living vectors including wind and water.

6. What important foods depend on the activity of pollinators?
    - There are many foods that depend on pollinators. Approximately 75 per cent of the world's food production depends on pollinators.
    - In our garden, foods like pumpkins, squash and cucumbers rely on pollinators.
    - Our chocolate and vanilla desserts rely on pollinators too!