Teacher Packs in Experimental Science

Bio Pack 4

Agents of pollination

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Curriculum areas covered:

Year 1 Semester 1 Unit 4.2 of the science curriculum for designated Science and Mathematics Colleges of Education, Ghana.

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Title: Agents of pollination
Target group*:* Diploma in Science Education
Also suitable for*:* Senior high school

Learning outcomes:

These are the learning outcomes expected after students have gone through this Pack

1. Knowledge and understanding

   KN1 Demonstrate knowledge and understanding of adaptation for pollination.

   KN2 Understand the role of pollinators and pollinating agents and give examples.

2. Cognitive skills

   CS1 Explain the nature of pollinator/agent interaction with flowers, especially the effect of color and other characteristics

   CS2 Apply knowledge and understanding of this experiment to suggest additional lines of investigation.

3. Key Skills

   KS 1 Describe, analyze and interpret scientific data

4. Practical skills

   PS 1 Make and record observations and report results

A. Teacher's Guide

Purpose: To investigate adaptations of flowers for pollination

Sample Assessment Questions

- What is a pollinator?

  (Answer: A pollinator is the biotic agent (vector) that moves pollen from the male anthers of a flower to the female stigma of a flower to accomplish fertilization)

- Describe the form and function of a named pollinator

  (Answer: bees are fuzzy and carry an electrostatic charge. Both features help pollen grains adhere to their bodies; any other acceptable pollinator)

- Describe why some flowers attract specific pollinators

  (Answer: Flowers with different characteristics such as: overall flower size, the depth and width of the corolla, the color (including patterns called nectar guides that are visible only in ultraviolet light), the scent, amount of nectar, composition of nectar, etc may attract different pollinators. For example, sunbirds visit red flowers with long narrow tubes and lots of nectar, but are not as strongly attracted to wide flowers with little nectar and copious pollen, which are more attractive to beetles).

B. **Student Guide**

Purpose: To investigate adaptations of flowers for pollination

Background Information

Unlike animals, plants are literally rooted to the spot, and so cannot move to combine sex cells from different plants; for this reason, species have evolved effective strategies for accomplishing cross-pollination. Some plants simply allow their pollen to be carried on the wind, as is the case with wheat, rice, corn, and other grasses. This method works well if the individual plants are growing close together. To ensure success, huge amounts of pollen must be produced, most of which never reaches another plant.

Most plants, however, do not rely on the wind. These plants employ pollinators - bees, butterflies and other insects, as well as birds, bats and mice - to transport pollen between sometimes widely scattered plants. While this strategy enables plants to expend less energy making large amounts of pollen, they must still use energy to produce incentives for their pollinators. For instance, birds and insects may be attracted to a plant by food in the form of nectar, a sugary, energy-rich fluid that bees eat and also use for making honey. Bees and other pollinators may be attracted by a plant's pollen, a nutritious food that is high in protein and provides almost every known vitamin, about 25 trace minerals, and 22 amino acids. As a pollinator enters a flower or probes it for nectar, typically located deep in the flower, or grazes on the pollen itself, the sticky pollen attaches to parts of its body. When the pollinator visits the next flower in search of more nectar or pollen, it brushes against the stigma and pollen grains rub off onto the stigma. In this way, pollinators inadvertently transfer pollen from flower to flower.

Flowers are designed to attract pollinators, and the unique shape, color, and even scent of a flower appeals to specific pollinators. Birds see the color red particularly well and are prone to pollinating red flowers. The long red floral tubes of certain flowers are designed to attract hummingbirds but discourage small insects that might take the nectar without transferring pollen. Flowers that are pollinated by bats are usually large, light in color, heavily scented, and open at night, when bats are most active. Many of the brighter pink, orange, and yellow flowers are marked by patterns on the petals that can be seen only with ultraviolet light. These patterns act as maps to the nectar glands typically located at the base of the flower. Bees are able to see ultraviolet light and use the colored patterns to find nectar efficiently.

These interactions between plants and animals are mutualistic, since both species benefit from the interaction. Undoubtedly plants have evolved flower structures that successfully attract specific pollinators. And in some cases the pollinators may have adapted their behaviour to take advantage of the resources offered by specific kinds of flowers.

Equipment/ Materials needed

Flowers from various plants
Guide pins

Other requirements

A sketch book
Notebook
Pens and pencils for drawing and note-taking

Experimental Procedure

a) Collect flowers of various plants such as *Luffa sp., Tecoma sp., Delonix sp.* (flamboyant)*, Caesalpinia sp.* (Pride of Barbados)*, Crotalaria sp.* (Devil bean)*, Hibiscus sp., Panicum maximum* (guinea grass), *Pennisetum purpureum* (elephant grass), *Zea mays* (maize), and *Carica papaya* (pawpaw).
b) Observe the features of these flowers carefully.
c) Identify the following, and give reasons for your identification:
    i. flowers that are likely to be pollinated by insects
    ii. those likely to be pollinated by wind
    iii. the flowers that are likely to have self-pollination
    iv. those that may have cross-pollination

Reflection on the experiment

Take some time to reflect on the activity carried out. Ensure that you have understood the procedure followed. If clarification is needed, discuss it with your teacher or colleagues.

Do you think this activity could be done in a different way? Give reasons for your answer.

C. Assessment – Student's sheet

On completion of the experiment, you should answer the following questions:

1. Describe the form and function of a named of pollinator (KN1)

2. Explain why some flowers attract specific pollinators (KN1)

3. What is a pollinator? (KN1)

D. Useful links

Nyavor, C.B. and Seddoh, S. (2006). *Biology for Senior Secondary Schools.* Accra: Unimax Macmillan Publishers Ltd.

E. Health and Safety

Wash your hands with soap after all the activities

F. Evaluation

What are your impressions about the pack? What would you like to be included the next time round when you are doing this activity?