

Lesson 10 - D

Insect Damages to Leaves

Summary

Small animals are often overlooked in the fossil record, as people focus more intently on the bigger, more charismatic fauna. This is especially true when dinosaur fossils are around and are an area's best-known specimens. This part of the lesson will address some of the smallest members of the Hell Creek fossil record, insects. The fossils are not of the insects but instead show what insects did to the plants 67 million years ago. (Only a handful of insect fossils have been found compared with thousands of examples of insect leaf damage.) Like all trace fossils, we cannot say precisely which insect or arachnid damaged the leaves but we can get some insights into their size and their relationship with the plants. In this way, we learn a bit more about the food web of the Hell Creek. Studies of the insects at the time of the extinction event show that insects that generalized did better than insects that specialized.

In this lesson, the students will look at a variety of photographs of leaves with insect damage. The students will have to determine who caused this damage and why.

Objectives

Students will be able to:

1. Identify insect damage on fossil leaves
2. Describe how insects played a role in the Hell Creek ecosystem
3. List different types of insects that damage leaves

Estimated teaching time

NA

Groups

NA

Materials

- Worksheets and laminated plant damage photographs

Teacher Background

The following section is from Problem-Solver Guide for Gardeners adapted from Texas A& M's Earth Kind Program, which is coordinated through Extension Horticulture. Earth Kind uses research-proven techniques to provide maximum gardening and landscape enjoyment while preserving and protecting our environment.

<http://aggie-horticulture.tamu.edu/earthkind/index.html>

Insects with chewing mouthparts

Chewing insects feed by biting, ripping or tearing plant tissue. They may damage all or part of the plant including roots, stems, leaves, buds and open flowers. Chewing insect pests on plants include caterpillars, beetles, grasshoppers, leaf-cutter bees, etc. Chewing insects produce varied plant damage including:

- Irregular holes in foliage or stems.
- Leaves with "windowpanes", i.e., showing bared veins (caused by leaf skeletonizing insects).
- Circular to semicircular holes in leaves (e.g., leaf-cutting bees).
- Caterpillars use their chewing mouthparts to consume several times their own weight in plant tissue over the course of their development. Much fibrous tissue passes through the caterpillar gut undigested and forms a major component of the large fecal pellets caterpillars leave behind. These pellets are characteristic of caterpillar damage.

Insects with sucking/piercing mouthparts

Many insects feed on a liquid diet (i.e. plant fluids) for which chewing mouthparts are not effective. Many of these insects have a beak, referred to as a proboscis that is modified to suck up liquids in a manner similar to humans sucking through a straw. The proboscis has a groove down its front inside which contains several very slender, sharp, and needle-like stylets that can pierce plant tissue to extract plant fluids (think mosquito). Sucking insect pests on plants with sucking/piercing mouthparts include aphids, leafhoppers, scale insects, whiteflies, etc. Insects with sucking/piercing mouthparts produce varied plant damage including:

- Discoloration (yellow or brown), mottled or necrotic (dead) spots on leaves or petals.
- Circular spots often with a darker rim.
- Many insects pests that feed in this manner secrete a sticky liquid (known as honeydew) that often builds up on the upper side of leaves or fruit, leaving a shiny residue that may support the growth of a black or gray sooty mold.

Insects with rasping/sucking mouthparts

Insects with rasping/sucking mouthparts actually rasp or scrape the surface of plant tissue (such as leaves or petals) and suck up the fluids that ooze from the damaged area of tissue. Examples of pests with rasping-sucking mouthparts include thrips and mites.

Insects may also lay eggs in leaves.

When the eggs hatch the young will then feed on the leaves. The damage comes in a variety of shapes and sizes but is often repeated multiple times. Sometimes a plant will respond to egg laying by producing a chemical reaction. The irritated plant tissue quickly surrounds the egg and produces what is known as a gall. Egg laying insects produce plant damage including:

- For eggs they come in a variety of shapes and sizes but are often repeated multiple times.
- Galls may look like tiny blisters, round balls, tubes, or circle around a center alteration. The gall surface may be smooth, hairy, or covered with spines.

Facilitating the activity

Pass out the worksheet and photographs to students. As noted in the introduction to this lesson, teachers should give a broad overview of activity to the students and tell them that each group is contributing to solving the overall issue of the paleoenvironment of the Hell Creek.

See Introduction to Lesson Ten for information on Assessment, Going Further, References, Teaching Standards, and Glossary.

Lesson 10 - D

Insect Damage to Leaves

In this activity you will look at a variety of fossil leaves, each of which has been altered by insects. Your goal is to try and figure out what type of insect made the damage.

Insects with chewing mouthparts

Chewing insects feed by biting, ripping or tearing plant tissue. They may damage all or part of the plant including roots, stems, leaves, buds and open flowers. Chewing insect pests on plants include caterpillars, beetles, grasshoppers, leaf-cutter bees, etc. Chewing insects produce varied plant damage including:

- Irregular holes in foliage or stems.
- Leaves with "windowpanes", i.e., showing bared veins (caused by leaf skeletonizing insects).
- Circular to semicircular holes in leaves (e.g., leaf-cutting bees).
- Caterpillars use their chewing mouthparts to consume several times their own weight in plant tissue over the course of their development. Much fibrous tissue passes through the caterpillar gut undigested and forms a major component of the large fecal pellets caterpillars leave behind. These pellets are a characteristic sign of caterpillar damage.

Insects with sucking/piercing mouthparts

Many insects feed on a liquid diet (i.e. plant fluids) for which chewing mouthparts are not effective. Many of these insects have a beak, referred to as a proboscis that is modified to suck up liquids in a manner similar to humans sucking through a straw. The proboscis has a groove down its front inside which contains several very slender, sharp, and needle-like stylets that can pierce plant tissue to extract plant fluids (think mosquito). Sucking insect pests on plants with sucking/piercing mouthparts include aphids, leafhoppers, scale insects, whiteflies, etc. Insects with sucking/piercing mouthparts produce varied plant damage including:

- Discoloration (yellow or brown), mottled or necrotic (dead) spots on leaves or petals.
- Circular spots often with a darker rim.
- Many insects pests that feed in this manner secrete a sticky liquid (known as honeydew) that often builds up on the upper side of leaves or fruit, leaving a shiny residue that may support the growth of a black or gray sooty mold.

Insects with rasping/sucking mouthparts

Insects with rasping/sucking mouthparts actually rasps or scrapes the surface of plant tissue (such as leaves or petals) and sucks up the fluids that ooze from the damaged area of tissue. Examples of pests with rasping-sucking mouthparts include thrips and mites.

Insects may also lay eggs in leaves.

When the eggs hatch the young will then feed on the leaves. The damage comes in a variety of shapes and sizes but is often repeated multiple times. Sometimes a plant will respond to egg laying by producing a chemical reaction. The irritated plant tissue quickly surrounds the egg and produces what is known as a gall. Egg laying insects produce plant damage including:

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- Galls may look like tiny blisters, round balls, tubes, or circle around a center alteration. The gall surface may be smooth, hairy, or covered with spines.

For each of the six photographs of Hell Creek plants with plant damage, please answer the following questions.

1. Please describe the damage.
2. What was the insect doing (eating, sucking, laying eggs, etc.) to this plant?
3. Why do you think this?
4. Have you ever seen this type of plant damage in modern plants? If so, where did you see it?