Winter Entomology Investigation

Target Grade Level: 5th

Created and Adapted by:
Rachel Loehman

UNIVERSITY OF MONTANA GK-12 PROGRAM

1) CONTRIBUTOR'S NAME: RACHEL LOEHMAN

2) NAME OF INQUIRY: WINTER ENTOMOLOGY INVESTIGATION

3) GOALS AND OBJECTIVES:
   a) Inquiry Questions:
      i) What are insects?
      ii) How do insects survive the winter?
      iii) Where can we find insects during winter months?

   b) Ecological Themes:
      i) Adaptation
      ii) Survival
      iii) Community ecology

   c) General Goals:
      i) Demonstrate that adaptations allow organisms to survive harsh environments
      ii) Winter is not a "dead" season

   d) Specific Objectives:
      i) Guide students in discovering where insects "hide" during the winter
      ii) Investigate methods used by insects to survive harsh environmental conditions

   e) Grade Level: 5

   f) Duration/Time Required: 4 hours
      - Prep time .5 hours
      - Implementing Exercise During Class 1 hour
      - Follow-up activities 2 hours
      - Assessment .5 hours

4) ECOLOGICAL AND SCIENCE CONTEXT:
   a) Background (for Teachers):

<u>How do insects survive the winter?</u>

Galls: Some insects survive the winter by creating galls on plants. A gall is made up of extra thick layers of plant tissue that grow around an insect. Usually an adult insect lays an egg on the plant's surface. The young larva that hatches from the egg, bores into the plant tissue where it becomes surrounded by the gall. Once the gall has formed, the insect stays happily inside the gall, pupates, and emerges in the spring when the weather is nice. There are more than 1500 gall-forming insects in North America. Most gall-forming insects are wasps, flies, beetles and moths.

Migration: One of the most well known migrating insects is the monarch butterfly. Large numbers of monarchs move south in the fall. Some monarchs have traveled a record 1800 miles, from Canada to Mexico. In the spring, the monarchs head north again. They usually do not make it all the way "home" before stopping to lay eggs and dying. The eggs hatch and the larvae quickly develop into butterflies. These adults will continue to head north.

Chemical Defense: The Mourning Cloak butterfly builds up a chemical in its body that resembles antifreeze, thus enabling it to overwinter as an adult in tree holes.

Burrowing: Some insects successfully pass the winter by burrowing into the soil lower than the frost line and live there as immatures (e.g., pupae or larvae) or adults. Many layers of leaf litter and even blankets of snow benefit insects by insulating the ground and keeping the temperature surprisingly constant. Ants and termites can survive the cold by moving to deeper areas within their underground colonies. We may

not be able to see them, but they are alive and well beneath the earth's surface. Ants store food to use during the winter when they are not able to go out to find food.

Underwater: Stoneflies nymphs can be found in fast-flowing shallow streams that do not freeze during the winter months. Some adults emerge from the water during the winter and can be found resting on rocks and plants near the stream bank. Other aquatic insects, such as dragonflies and damselflies spend the winter underwater as naiads, the immature life stage between egg and adult. Ice-covered ponds can be homes for water boatmen and backswimmers. They stay in air pockets under the ice.

Deep Sleep (diapause): Insects that are not active during the winter months may enter a state in which their growth, development, and activities are suspended temporarily. This dormant condition, called *diapause*, is similar to the hibernation of vertebrate animals

Body heat: Unlike most bees and wasps that die when the weather turns cold, honey bees are able to use their bodies and wings to create heat inside their hives. A group of bees crowd together in the middle of the hive where they move their bodies and wings to create heat. Another group of bees make a ring around the heat-producing bees to keep the heat from escaping from the hive. When the heat-producing bees get tired, they trade places with the bees in the outer ring. The bees are able to keep the temperature in their hives from dropping below 57øF (14øC). In addition, throughout the year the honey bees use propolis, a sticky substance made up of plant resins and other substances mixed together by the bees, to "caulk" their hives. They spread the propolis all over the inside of the hive. It glues the individual hive cells together and seals any cracks that may have formed in the hive.

b) Background (to present to Students): Adapted for presentation on overheads or as a PowerPoint presentation.

Winter Entomology Investigati

What do you know about insects?

A cockroach can live for nine days without its head.

Dragonflies can fly at speeds up to 30 miles per hour.

There are many more kinds of insects on earth than any other kind of living creature.

95% of all the animal species on the earth are insects!

One out of every four animals on earth is a beetle.

Insects eat more plants than all the other creatures on earth!

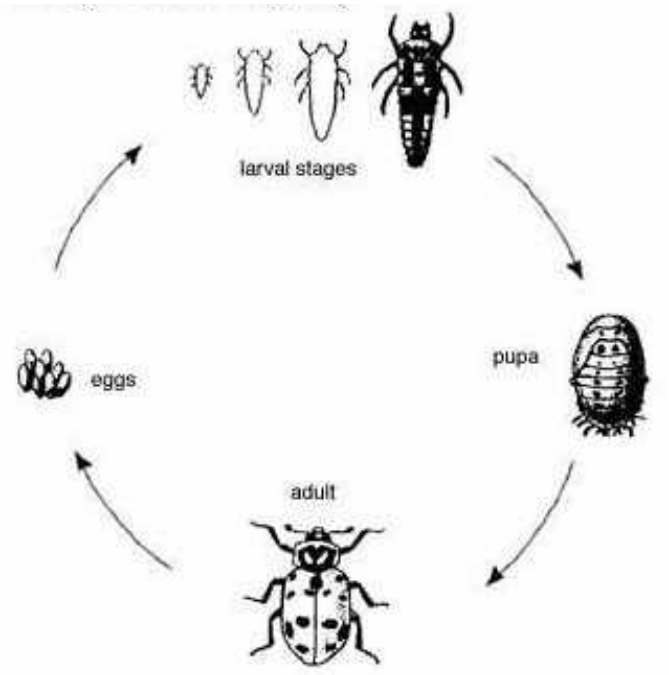
Insects are a  od source for many other animals.

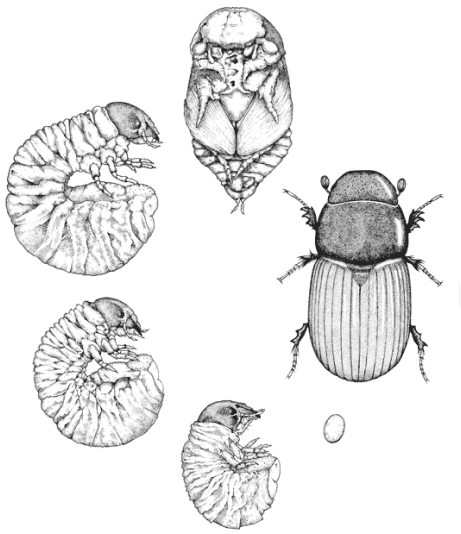
Insects are cold-blooded.

All insects must have:

- three body parts - a head, thorax, and abdomen
- six jointed legs
- two antennae to sense the world around them
- an exoskeleton (outside skeleton)

Insects usually go through four separate life stages:
egg, larva or nymph, pupa, and adult.





How do insects survive the winter?

Migration (Monarch butterfly)

Create galls (wasps, flies, beetles, moths)

Chemical antifreeze (Mourning Cloak butterfly)

USDA-ARS

Metzneria paucipunctella pupa (left) and larva (right) in knapweed seed heads.

Underwater (dragonflies, damselflies)

Burrowing (larvae, pupae, or adults)

Deep sleep (diapause)

Body heat (honey bees)

Where might we find insects today in our schoolyard?

Near buildings

In and under tree bark

In stumps

Under snow

In curled leaves

Inside galls

Why study insects?

Decomposers

Nutrient cycling

Ecological relationships

Learn about adaptations

5) MOTIVATION AND INCENTIVE FOR LEARNING: Learn about interactions between insects and their environments; discover ways organisms adapt to their environment; find “hiding places” for insects in the schoolyard.

6) VOCABULARY:
   a) Insect: Any of numerous usually small arthropod animals of the class Insecta, having an adult stage characterized by three pairs of legs and a body segmented into head, thorax, and abdomen and usually having two pairs of wings. Insects include the flies, crickets, mosquitoes, beetles, butterflies, and bees.
   b) Diapause: A period during which growth or development is suspended and physiological activity is diminished, as in certain insects in response to adverse environmental conditions.
   c) Adaptation: An alteration or adjustment in structure or habits, often hereditary, by which a species or individual improves its condition in relationship to its environment.
   d) Overwinter: Survive through the winter.
   e) Gall: An abnormal swelling of plant tissue caused by insects, microorganisms, or external injury.
   f) Thorax: The second or middle region of the body of an insect, between the head and the abdomen, in insects bearing the true legs and wings.
   g) Abdomen: The posterior segment of the body in insects.
   h) Larva/larvae: The newly hatched, wingless, often wormlike form of many insects before metamorphosis.
   i) Metamorphosis: A change in the form and often habits of an animal during normal development after the embryonic stage. Metamorphosis includes, in insects, the transformation of a maggot into an adult fly and a caterpillar into a butterfly and, in amphibians, the changing of a tadpole into a frog.
   j) Pupa/pupae: The nonfeeding stage between the larva and adult in the metamorphosis of insects, during which the larva typically undergoes complete transformation within a protective cocoon or hardened case.

7) SAFETY INFORMATION: STUDENTS SHOULD WEAR WARM CLOTHES AND STURDY SHOES

8) MATERIALS LIST (including any handouts or transparency masters): TRANSPARENCIES, MAGNIFYING LENSES OR BOXES, INSECT FIELD GUIDES.

9) METHODS/PROCEDURE FOR STUDENTS:
   a) Pre-investigation work: Students learn about insects: anatomy, ecological functions (pollinators, decomposers), life cycles, winter adaptations and strategies for survival. Students are asked to list places in their schoolyard where they might find overwintering insects.
   b) Investigation work:
      (1) What evidence (data, samples) do students collect? Students can collects insects, or study them in the field.
      (2) How do students present the evidence (data)? Groups present lists of insects they found, where the insects were found, and what strategies/adaptations enabled overwinter survival.
      (3) What conclusions are drawn from the evidence students collect? Various behavioral or physical adaptations and strategies help organisms survive harsh conditions; during winter everything is not “dead.”
      (4) Include examples of data sheets. See Winter Entomology Data Sheet.doc

10) ASSESSMENT: Gauge student enthusiasm for learning about and finding insects in the schoolyard, and through follow-up discussion.

11) EXTENSION IDEAS: IDENTIFY SPECIFIC INSECTS USING FIELD GUIDES; MAP SCHOOLYARD WITH OVERWINTERING SITES; TRACK LOCATION AND BEHAVIOR OF INSECTS THROUGH SEASONS

12) SCALABILITY APPROPRIATE FOR YOUNGER GRADES AS WELL

13) REFERENCES:
   a) *Winter Hideaways*. University of Kentucky Department of Entomology, http://www.uky.edu/Agriculture/Entomology/ythfacts/allyr/yf806.htm

   b) *Science 101: How do insects survive winter?* Science and Children, November/December 2003, p.19, National Science Teachers Association.

c) *Snowy Entomology*. Science and Children, November/December 2003, p.41,National Science Teachers Association

d) Insect Facts and Information (http://www.ivyhall.district96.k12.il.us/4th/kkhp/1insects/buginfo.html)

e) *Where Do Insects Go In the Winter?* Smithsonian Institution Entomology, http://www.si.edu/resource/faq/nmnh/buginfo/start.htm

14) LIST OF EXPERTS AND CONSULTANTS: JEN MARANGELO

15) EVALUATION/REFLECTION BY FELLOWS AND TEACHERS OF HOW IT WENT: Students enjoyed learning facts about insects, and their methods for survival in harsh conditions. Teachers liked leading students in the discovery of insects and habitat areas in the schoolyard. Many students predicted that there would be no insects present in the schoolyard, and were excited to find a variety of insects. A large number of larva were discovered in seed heads of knapweed plants in the schoolyard, prompting development of a Knapweed Biocontrol Investigation.

Winter entomology notes for teachers

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Snowy Entomology Data Sheet

Names_____

Date_____

Sky conditions: Cloudy Partly Cloudy Sunny

Precipitation: None Rain Snow Sleet

Air Temperature °F: _____

Drawing and description of the insect: Color (black, brown, red, stripes, other) Size (pinhead, dime, quarter, other) What else (antennae, stinger, wings, legs, etc.)?	**Life cycle stage:** Egg, larva, pupa, or adult	**Location:** On or under the snow? Under bark or leaves? Inside a gall? On or near a building?	**How was it moving?** Motionless Slow-moving Fast-moving Other (explain)

Adapted from Snowy Entomology, Science and Children, November/December 2003, p.41.National Science Teachers Association

List other evidence of insects you found: (beetle tunnels, insect nests, dead insects, etc.):_____