



Science Unit: *The Earth Around Us: Air, Water & Soil*

Lesson 5: *Worm Composting*

School year: 2007/2008

Developed for: Carnarvon Elementary School, Vancouver School District

Developed by: Linda Hanson (scientist), Moira Corrigan and Tania Pearse (teachers)

Grade level: Presented to Grade 2; appropriate for grades 1 – 7 with age appropriate modifications.

Duration of lesson: 1 hour and 15 minutes

Notes: Worm composting bins (and worms) can be purchased from Transform Compost Systems: 3911 Mt. Lehman Road; Abbotsford, BC V4X 2N1; 604 856 2722; www.transformcompost.com.

Alternatively bins can be purchased at a discounted price if the teachers/scientist is a Vancouver resident and participates in the worm composting workshop run by City Farmer. <http://www.cityfarmer.org/> or call the City Farmer compost hotline at 604 736-2250.

Bins can also be made. Instructions are provided in “Worms eat my garbage” which is referenced at the end of the lesson.

Objectives

1. To set up a worm composting bin.
2. To learn about the role worms play in decomposition and hence soil formation.
3. To learn about worm anatomy.

Background Information

Worms are just one of many soil invertebrates that contribute to decomposition and soil formation. The actions of living organisms break down organic detritus allowing nutrients to be recycled back into the soil. These nutrients are then available for uptake by plants. The process of decomposition can be physical (breaking into smaller pieces) or chemical (due to digestion by enzymes and secretions). It may help the students if you present decomposition as being like biological weathering. Having a worm composter in the classroom will allow the students to observe decomposition in action and over time they will see the bedding in the compost bin turn into worm castings – a soil-like material that is a very rich fertilizer.

Red wiggler worms are the species most appropriate for an indoor worm composter. They thrive at room temperature and have voracious appetites. Worms have no skeleton and no teeth. They suck small particles of food into their mouth and these are moved down the esophagus and into a structure known as the gizzard. The gizzard is a small muscular pouch also found in birds. The gizzard contains small particles of rock which the worms have also ingested. The muscular actions of the gizzard as well as the rocks it contains grind up the worm’s food. The food is then passed on to the intestines and the “castings” are excreted. The rocks in the gizzard will get worn down and thus the worm must periodically inject new rock particles.



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Worms are hermaphrodites; however, they must mate with another worm in order to reproduce. After mating fertilized eggs are deposited in a cocoon which is produced by the saddle. The saddle is located at the anterior (head) end of the worm.

Worms move via a series of muscular contractions. Locomotion is aided by setae, hair-like bristles located on the surface of the worm's body. First the worm uses its circular muscles to lengthen its body and extend the head forward (or the tail if it is moving backwards). The setae stick into the soil and act as anchors. The worm then contracts its longitudinal muscles to "pull" the tail forward.

Vocabulary

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| <u>decomposition:</u> | The physical or chemical destruction of organic matter by living organisms. |
| <u>setae:</u> | Small hair-like bristles that aid the worm in locomotion |
| <u>saddle:</u> | Where the reproductive organs of the worms are located. This is also where the eggs are fertilized and the cocoons are made. |

Materials

- Worm bin & tray
- soil
- red wiggler worms
- straw
- sand
- food items (see below)
- shredded newspaper
- water
- worksheets

In the Classroom

Introductory Discussion

1. Review last week's lesson on soil. Focus the discussion on the organic material the students found in the soil samples.
 - Why is this organic debris important?
 - Can plants absorb little pieces of organic debris?
 - The organic material needs to be broken down to release the nutrients and make it available to plants. This process is known as decomposition.
 - Today we are going to learn about one kind of decomposers, worms. We are going to build a home for worms where we can watch them in action. Discuss the fact that different species of worms have different preferences and so the worm bin will contain red wiggler worms as they are best suited to an indoor composting bin.
 - What needs must worms and other decomposers meet in order to survive? Record brainstorm on the board (air, water, food, shelter)
2. Short description of other items to discuss or review.
 - Discuss respect for living organisms.
 - Ensure the teachers are familiar with the proper care and maintenance of the worm bin (instructions are provided if the worm is purchased from Transform compost systems and further information is available in "Worms eat my garbage" which can also be purchased from Transform compost systems.
3. Briefly describe science experiment/activity.



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- The students will learn about the components of the worm bin. They will then examine a worm to learn about worm anatomy and locomotion.
4. Students will focus on making and recording observations for this activity.
 5. Briefly describe safety guidelines.
 - Handle the worms with care. Be sure that your hands are clean and that the worms are kept moist at all times.
 - Wash your hands when you are finished handling the worms.

Science Activity

Activity Title: Let's learn about worms!

Purpose of Activity: To learn about the construction and maintenance of the worm composter and to learn about worm anatomy.

Methods and Instructions:

Set-up prior to experiment: Worm compost kits (bin, bedding, worms, and instructions) can be obtained from Transform Compost Systems. Depending on when the kit is picked up the worm composter may already be assembled when you bring it into the classroom.

Students will work in groups while observing the worms but will record their observations individually.

1. Start by discussing each item in the bin by relating it back to the survival needs the students listed previously. As the items are discussed the students can fill out the appropriate information on their worksheets.
 - a. Shelter: bin, bedding
 - b. Water: the bedding was dampened before being placed in the bin. We will also add more water as necessary.
 - c. Air: the bin has air holes for aeration, we will also turn the bedding periodically to ensure it remains aerated.
2. The next item to discuss is food. What do worms eat? (organic matter). Technically the worms eat the bacteria and fungi that grow on the food stuff introduced to the bin, you may or may not want to make this distinction depending on the age of the students. How do worms eat? Have the students suggest ideas. Do they have teeth? (no) Introduce the concept of the gizzard, equate it to weathering. In order to help the worms digest their food we added a small handful of soil and sand to the composter.
3. Discuss worm care. Brainstorm a list of possible food items. Discuss the suitability of each item.

| Good Food | Unsuitable food |
|--|---|
| Fruit and fruit peels | Dairy products |
| Vegetable scraps and peels | Meat |
| Crushed egg shells | Oily foods (salad dressing, french fries) |
| Coffee grounds and filters, tea bags | Grains (bread, cereal, crackers) |
| Citrus peels (in small quantities) | Bones |
| Banana peels (freeze first to kill fruit fly eggs) | |



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Dairy products, meat, meat bones, and oily foods are unsuitable for an indoor composter as they tend to be quite smelly while they are decomposing. This is due to the type of bacteria that are required for their decomposition. They also have a tendency to attract rodents and other undesirable pests. Grains should also be avoided or added in limited quantities as well due to their propensity to attract rodents. Citrus peels should be added in small quantities as the citrus oil can be irritating to a worm's sensitive skin. If you are worried about fruit flies freeze items such as banana peels (which tend to contain fruit fly eggs) before adding them to the compost (defrost before adding them).

4. The students can calculate how much to feed the worms as part of their math lesson. The worms will eat approximately half of their body weight per day.
5. Hand out the worms (one per student) and discuss worm anatomy. What do worms look like? How do you tell the head from the tail? What do you see with the magnifying glass? How do worms move? Introduce the appropriate vocabulary (eg. setae) as the discussion progresses.

Closure Discussion

1. How do worms move? Discuss student ideas and explain how the worm uses its muscles in conjunction with its setae to propel itself forward. Also discuss the mucus worms secrete to keep their skin moist (for breathing) and aid in locomotion.
2. Have the students ask any questions they have about worm care and anatomy and discuss the answers as a class. Introduce some interesting aspects of worm anatomy and physiology. For example worms breathe through their skin, worms have more than one heart, worms can regenerate their tail segments if they are ripped off or eaten by a predator (but only some species and ONLY if no vital organs were present in the lost piece – the lost piece will NOT grow into another worm), the longest worm ever found was over 22 feet long.

References

1. Appelhof, Mary. 2003 Worms eat my garbage: how to set up and maintain a worm composting system. Flower Press.
2. <<http://www.cityfarmer.org/wormcomp61.html>> Gillian Elcock and Josie Martens. Composting with red wiggler worms. Hosted by City Farmer, Canada's Office of Urban Agriculture. Copyright 1995. Accessed February 1 – April 31, 2008.

Scientist: _____

Date: _____

Let's learn about worms!

Draw and label a picture of our worm bin



Our worms are _____.

The bedding in our worm bin is _____ and
_____.

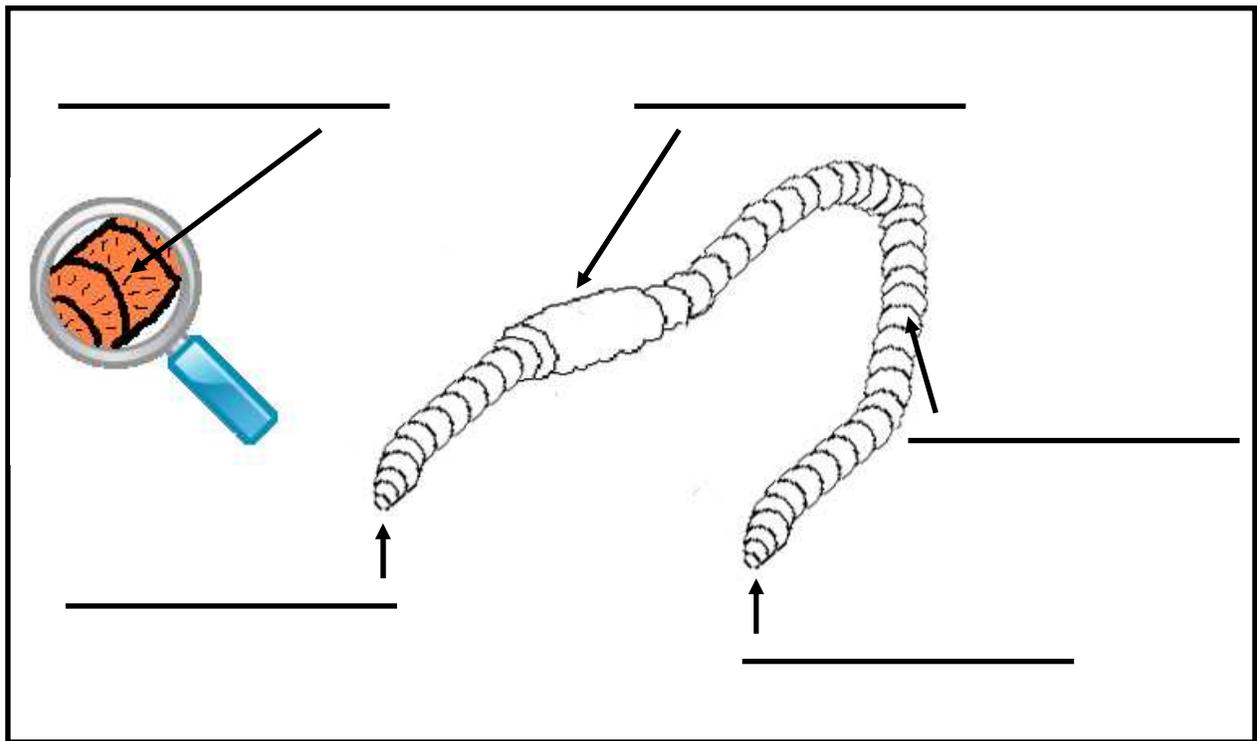
We added _____ to make the bedding _____.

We also added _____ and _____ to
help the worms digest their food.

What foods do our worms like to eat?

What foods should we not feed our worms?

Label the parts of the worm:



tail head segment saddle setae

Observe your worm. How do you think worms move?
