

## Counting Critters

When JASON host researcher Dr. Mike Kaspari embarks on a new expedition to study his favorite subject, he doesn't need to go as far away as Panama to find something interesting. Because he focuses on the animal communities that live in leaf litter, he can find samples to study everywhere. Even on school grounds, fascinating critters can be found just under bushes or trees—anywhere dead leaves and pine needles accumulate. In this activity, you will collect leaf litter samples from different sites in your area. Next, you will extract the critters from the sample using an instrument called a Berlese funnel. You will then classify insects collected from each sample and compare the number of species (biodiversity) and number of individuals (abundance) found at each site.

### Focus questions

What role do arthropods play in a rainforest ecosystem?

How do scientists sample and classify different species of arthropods in leaf litter?

Do different types of leaf litter differ in their abundance and biodiversity of arthropods?

### Materials

#### For each team

- 1 Berlese funnel (or materials to build one, listed on **Master C**)
- 1 bottle of rubbing alcohol
- Measuring cup
- 1 large, sealable plastic bag
- Rubber gloves
- 20- to 40-watt table lamps
- Filter paper (or paper towels)
- 3 or 4 Petri dishes (to collect critters of the same species)
- Paper cup

Small plastic funnel

Magnifying glass or, preferably, a dissecting microscope

Tweezers

Small bottles with caps (for saving preserved arthropods)

Copy of **Master C** (Berlese funnel setup)

Copy of **Master D** (arthropod identification)

#### For each student working with the alcohol

Safety goggles

### Procedure

#### Part A: Equipment Setup

1. Divide into teams. Each team will collect and analyze a different leaf litter sample.
2. Each team should have a Berlese funnel. To build one, follow the instructions on **Master C**.

#### Part B: Collecting a Litter Sample

3. With the help of your teacher, select a place and a day to collect your leaf litter sample. Leaf litter can be collected under different types of trees or shrubs. It will yield the most organisms if the weather is warm and neither very wet nor very dry.
4. To collect the sample, one member of your team will put on the rubber gloves and gather two cups of leaf litter in your assigned spot. For best results, remove the surface layer of leaves and collect the layers below it. Collect all the way down to the soil, but try not to get too much soil.
5. Store your sample in a plastic bag, then seal the bag. Label it with your group number. In your journal, record the following information for your sample area: plants present, location, date, time of day, and weather conditions.

**Part C: Extracting Arthropods from Leaf Litter**

6. Extract arthropods from your litter sample, following the directions on **Master C**. Start the extraction process as soon as possible, preferably within a few hours of collecting your sample.
7. Once you complete the extraction and carefully remove the collecting jar, discard the leaf litter outside where you found it.

**Part D: Observing Your Arthropods**

8. Wearing safety goggles, observe the arthropods in the alcohol. Count how many individual critters were extracted from your sample. Do you recognize any of them? In your journal, write your initial estimate of the number of individuals in your sample and the names of the species you recognize, using the key or the Web sites from **Master D**.
9. While wearing safety goggles, filter your alcohol sample: pour it over a piece of filter paper lining the inside of a small plastic funnel perched on a paper cup. Remove the filter paper while it is still slightly moist and save the alcohol (it should be clear now) for the next extraction.
10. Analyze your filter paper with a magnifying glass. Count the number of individual critters. Report the number in your journal. Is this the same number of individuals you saw with your naked eye? Repeat the visual analysis with the help of a microscope, if available. How many individual critters do you see now?
11. With the help of a magnifier, find arthropods that look alike (for example: have the same size and shape, have the same number of legs, have the same number of body segments, have wings). Pick them up with the tweezers and group them in a Petri dish. Be sure to keep different groups separated in the dish. Use additional Petri dishes if needed.
12. Write down the number of different groups of critters (biodiversity) in your leaf litter and the number of individuals (abundance) in each group.

13. With the help of **Master D** and the magnifier, try to identify all the species of arthropods in your sample. Write down the number of groups (diversity) and the number of individuals in each group (abundance).
14. Compare your leaf litter biodiversity and abundance with the results obtained by other teams.

**Conclusion**

1. Is the number of individuals (the abundance) of litter critters the same from site to site? What is the maximum number of litter critters from the same amount of litter? What is the minimum?
2. Was the biodiversity of species of litter critters different from site to site?
3. Which factors do you think might explain the difference in abundance and diversity in your samples?
4. How do you think your sample compares with samples collected by Dr. Kaspari in the rainforest?
5. How does this experiment show the connection between the green and brown food webs?

**For Further Exploration**

Prepare a card for each of the species you found in your sample. Make a drawing of the animal and search the Internet to gather information about that species' range, behavior, and role in its ecosystem.

Post the results of your leaf litter analysis on the message boards on Team JASON Online to compare your data with those of students from other areas.

# The Berlese Funnel

## Building a Berlese Funnel

The goal of litter sampling is to extract the arthropods that live in the dead leaves and twigs that lie on the ground. Many of these arthropods are very small. When a good patch of litter is sampled, it is amazing to discover how many unnoticed critters live right below our feet!

To perform the extraction, you need a Berlese funnel. Here is how to build one:

### Materials

2-liter soda bottle (preferably clear plastic with the label removed)

Piece of hardware cloth (with a mesh of  $\frac{1}{4}$  inch)

Desk lamp or similar light source (with a 20- to 40-watt light bulb)

Small jar or dish (2 centimeters deep) to catch the litter critters

Alcohol (rubbing alcohol is fine)

### Step 1

Use scissors to cut the soda bottle in half. While wearing safety goggles, fill the small jar or dish halfway with alcohol and place it at the bottom of the bottle. Turn the top half of the soda bottle upside down and put it inside the bottom section of the bottle.

### Step 2

Cut out a piece of hardware cloth about 6 inches square. Fold up the corners as shown to build a roughly circular platform that will nest inside the funnel part of the bottle. Your Berlese funnel is ready.

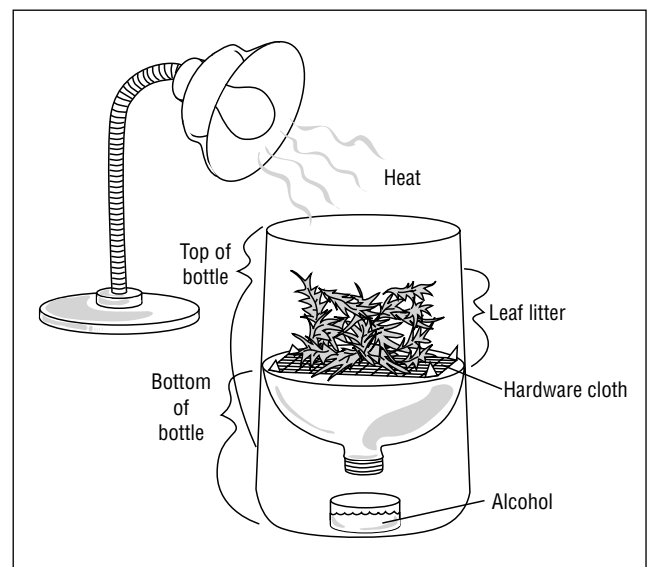
## Extracting Arthropods from Leaf Litter

Once you have your sample of leaf litter, remove the top portion of the Berlese funnel and gently scoop the litter from your plastic bag into the funnel. Some dirt and debris will fall through the mesh, so work over a trash can. When you have added the two cups of litter, gently nest the funnel back into the bottom half and move the lamp over the litter (see illustration).

Berlese funnels work by gently heating and drying the top of the litter. Since most critters like the litter

moist, they will work their way down until they fall through the mesh. The larger ones will tumble into the alcohol. Some of the smaller ones may “stick” to the tapered part of the funnel, especially if water condenses on the inside.

When the litter is dry (this usually takes about 24 hours), carefully lift the top portion away from the bottom. If you bump it, you may end up with a dish full of dirt! Pour off the litter into your plastic bag for disposal. With alcohol, rinse the funnel into the dish to get any small things that are stuck to the side. Don't forget to use safety goggles while working with the alcohol.

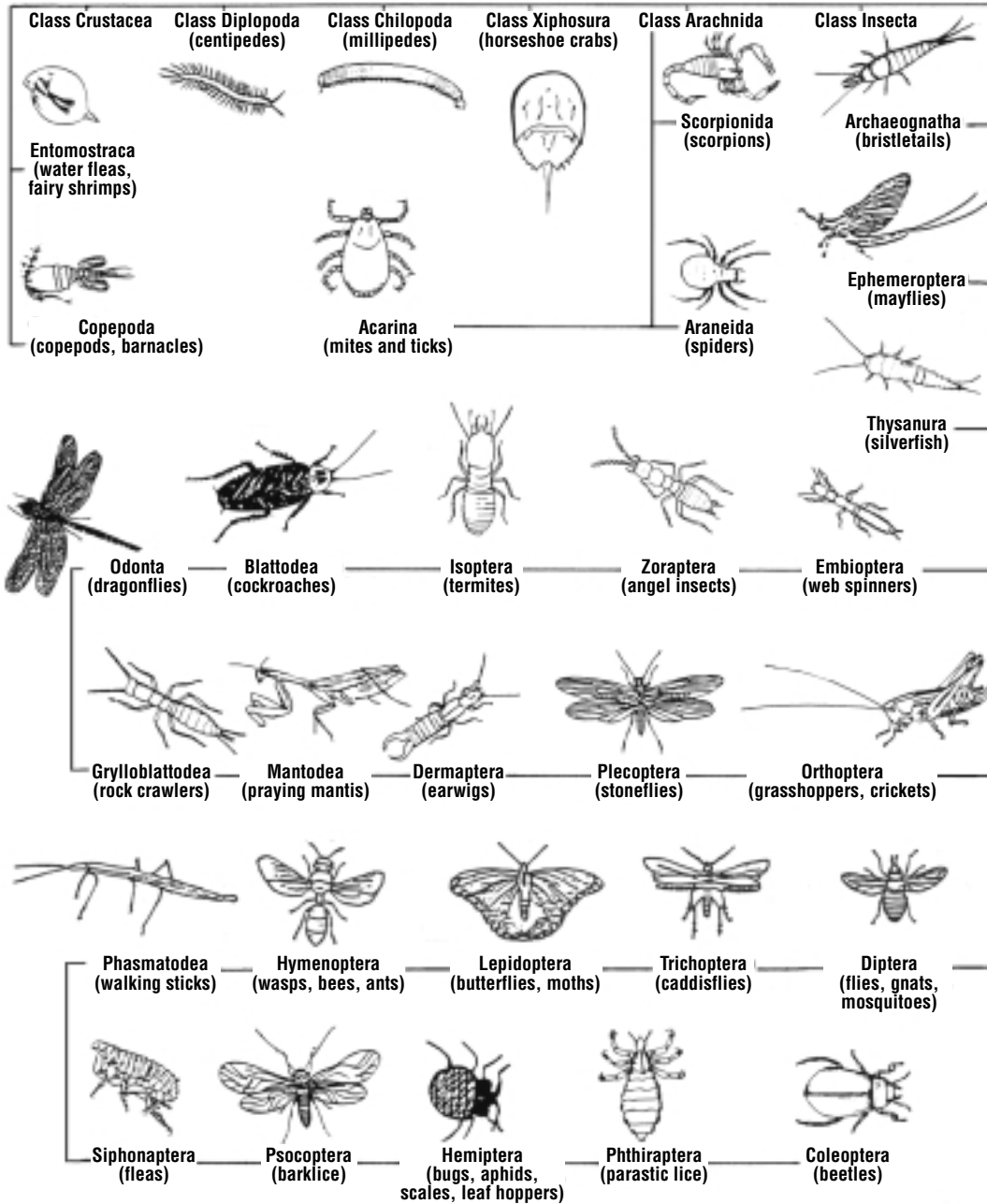


Remember to post  
your leaf litter data on  
Team JASON Online!



# Key to Arthropod Identification

## ARTHROPODS



*Developed by the University of Wisconsin-Extension in cooperation with the Wisconsin Department of Natural Resources. Based on a key developed by Riveredge Nature Center, Newburg, WI. May be reproduced with this credit for educational non-profit purposes. For information, contact UWEX Environmental Resources Center, 608/267-0020.*

In addition to this chart, the following Web sites may help you identify arthropods:

- [faculty-staff.ou.edu/K/Michael.E.Kaspari-1/littercritters.htm](http://faculty-staff.ou.edu/K/Michael.E.Kaspari-1/littercritters.htm)
- [www.oswego.edu/wscp/is-k.htm](http://www.oswego.edu/wscp/is-k.htm)
- [caplter.asu.edu/explorers/protocol/arthropods/key.htm](http://caplter.asu.edu/explorers/protocol/arthropods/key.htm)
- [www.arthropod.net/reference/insect\\_identification.htm](http://www.arthropod.net/reference/insect_identification.htm)