Lab #1, Soil Macrofauna
Forests Through Time and Space, Winter 05

Objectives

The objectives of this lab are to:

- Increase your understanding of the decomposition food webs that cycle carbon in forest soils;
- Acquaint you with the myriad macrofauna and mesofauna present in soil;
- teach you standard methods for isolation of arthropods and nematodes from soil;
- familiarize you with the features of many of the soil arthropods;

What to Bring to Lab

- plastic bags containing soil samples (most of these organisms are concentrated in the litter and organic horizons).
- enthusiasm for much maligned, noble earth-dwelling creatures

Background

Macrofauna (in soil microbiology) include a wide range of organisms, ranging in size from large insects to microscopic protozoa. Macrofauna play a critical role in the soil ecosystem by breaking down organic matter and increasing the surface area available for further decomposition by bacteria and fungi. They play important roles in regulating microorganism populations by preying on them. They are also important in altering soil porosity, e.g. earthworms. For additional details on soil animals and their role in decomposition, see the assigned readings for this lab.

Methods

Each lab group (2 students) should pick a soil that you will use for the first two labs. Take two soil samples, one for the Berlese extraction and the other for isolation of soil bacteria and fungi. For the Berlese extraction, collect about a liter of soil in plastic bag. Get the overlying litter and dig down to the bottom of the organic layer. For the bacteria and fungi sample, take it near the top of the organic layer, below the litter layer. Try to get a sample where the particulates are uniform and plant debris is no longer recognizable.

A standard method for collecting arthropods is the Berlese funnel (Fig 1). This simple apparatus consists of a funnel, screen, light bulb, and collecting jar. The heat generated by the light bulb drives the organisms through the soil sample into the funnel where they fall into the jar of ethanol and water.

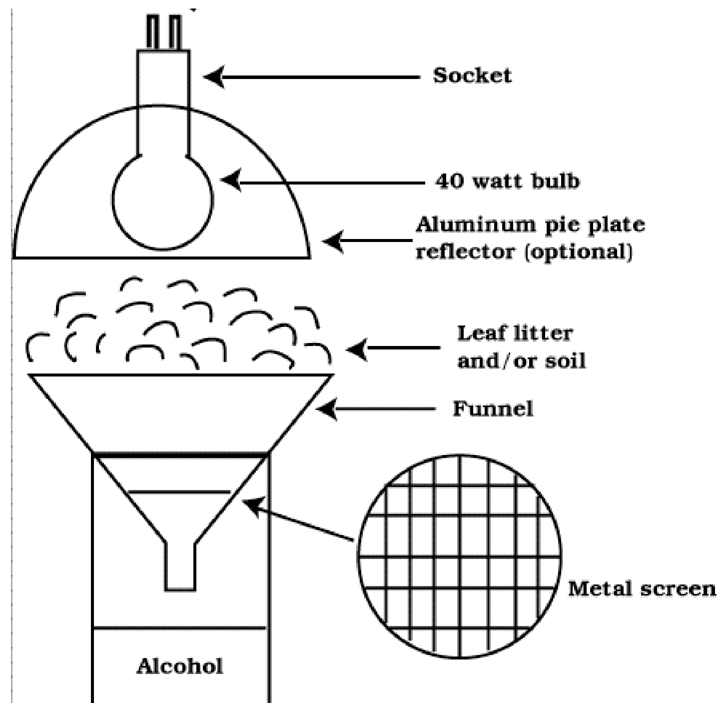

Figure 1. Berlese Funnel Apparatus

Set up Berlese extraction funnels (Week 1)

Materials—Berlese funnel setup, collection jar

1. There should be two screens in the Berlese funnel, a coarse screen and a piece of window screen. Put two or three layers of cheesecloth on top of the window screen.
2. Remove the collection jar from beneath the funnel (if there is one there). This is to prevent all sorts of debris that will fall down the funnel when you put the soil from being in your final sample.
3. Place your soil/litter sample on top of the cheesecloth. Put about 6 cm of sample in the funnel while the funnel is in the funnel holder. Clean up the debris that has fallen out of the funnel.
4. Aim the lamp above the sample. Heat from the lamp will drive the arthropods downward into the collection vial. The light intensity is critical. Too hot and the sample will dry rapidly, trapping many of the critters in the soil. Too cool and the sample will not dry and the critters won't move. Paul will adjust the light intensity once the funnels are filled.
5. Place a collection jar beneath the funnel and fill two-thirds full with ethanol/water mix.

Observe, sort, and count organisms (Week 3)

<u>Berlese funnel</u>

Materials—dissecting needle, petri dish lid, Pasteur pipette, good eyes

Descant off most of the alcohol from the collection jar and then pour the organisms into a petri dish lid. Observe with a dissecting scope. Count the number of arthropods in the majors groups (mites, springtails, beetles etc.) Observe and draw a representative from each group using either the dissection or compound microscope. Both partners should individually count the samples, then average your counts for each group. Create a data table and express the counts for each group as relative abundance numbers (number individuals per group divided by the total number of individuals counted for all groups).

Questions

1. Outline the advantages and disadvantages of this method for collecting soil fauna.
2. What biases (if any) do you see with this method?
3. How might you improve this method?
4. Share your data with two other groups who looked at different soil types. Compare and contrast the relative abundance of the organisms found. What do you think this means?