

Sampling for Soil Insect Pests

An Inexpensive Way to Build a Berlese Funnel

Many soil insects and related organisms are important crop pests. These include garden symphylans, root weevil larvae and adults, white grub larvae, flea beetle larvae, wireworms, clover root borer larvae and adults, sod webworms, mint root borers, and various subterranean cutworms.

These pests can be difficult to detect, and a great deal of time and effort is required to obtain enough samples to get a good estimate of soil pest populations. However, sampling for these pests can be made easier by using several Berlese funnels. Information on the life histories and management of these pests can be found in various OSU Extension publications. Consult the current list of publications available from county Extension offices.

The following materials are required for each Berlese funnel:

- two 5-gallon drums
- one 18 or 22 gauge sheet metal, 20" x 30"
- two welding rods, 1/4" X 12"
- one piece 1/8" screen, 12" X 12" (hardware cloth)
- one 1/2-pint canning jar and band
- one ceramic light socket, cord, and plug
- one electrical junction box
- one 60- or 100-watt bulb
- six sheet metal screws, 1/4" to 1/2" long

Do not use pesticide containers, due to possible toxic effects from residues present in the containers.

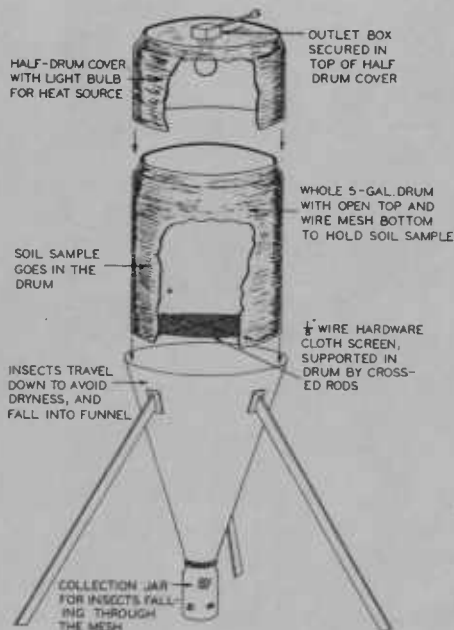


Figure 1. Schematic diagram of Berlese funnel.

Procedures for assembly

First, rinse containers well. Remove both ends from one of the 5-gallon containers. Flatten sharp edges with a hammer. Next, drill two 5/16-inch holes opposite each other, 3/4 inch from the bottom of the drum. A second set of 5/16-inch holes should be drilled 1/2 inch up from the bottom, spaced approximately 90° from the first set of holes. Insert 1/4" X 12-inch rods through opposite holes to form a cross support. Using the bottom of the drum as a pattern, cut a circle from the 1/8-inch screen and fit it into the bottom of the drum above the cross sup-

ports. Tie the screen to the cross supports with wire. (See Figure 1.)

To make the lid, cut the second drum in half crosswise. Cut a 1 1/2-inch hole in the end for the light bulb. Mount the ceramic socket in the electrical junction box and wire the cord to the socket. Attach the junction box, with the socket installed, over the 1 1/2-inch hole in the lid and screw in the light bulb from the underside.

The funnel is made from lightweight sheet metal (18 to 22 gauge), using the pattern in Figure 2. After cutting out the funnel, form the metal into a cone with 1 inch allowed for overlap. Fasten the seam with six sheet metal screws 3 inches apart. Next, solder the canning jar band to the narrow end of the funnel. The half-pint canning jar will be screwed

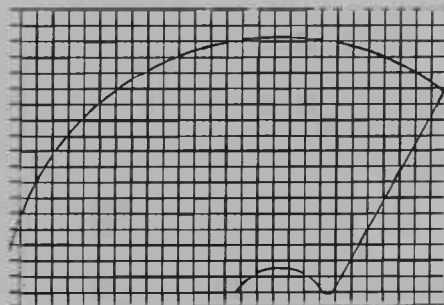


Figure 2. Pattern for the cone for Berlese funnel.

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into the band, so be careful not to damage or warp the band while soldering.

Mount the funnel securely (narrow end down) in order to support the cans and about 25 pounds of soil. The legs can be attached directly to the funnel if individual funnels are to be made, or several funnels can be placed in a series, constructing a frame for support.

The completely assembled Berlese funnel consists of a securely mounted sheet metal cone with canning jar and band attached to the cone's narrow end, a 5-gallon drum with the ends removed and wire screen installed over cross supports, and a half-drum with light bulb and socket installed (Figure 3).



Figure 3. Completed Berlese funnel.

Instructions for use

A soil and root sample or sod sample about 1 foot square by 2 to 4 inches deep (6 inches for root weevils and clover root borers) is placed inside the drum on the wire screen. The lid is placed on the top of the drum, slightly ajar, to allow moisture to escape from the soil, and the light bulb is turned on. The heat from the light bulb forces the soil insects out of the sample by drying the soil. These insects fall through the wire screen and slide down the funnel into the half-pint collecting jar. After the soil and roots are com-

pletely dry, the pests in the collecting jar can be removed, identified, and counted. Make sure the soil and roots are completely dry so that no pests remain in the sample. Some of the more common soil insects and other organisms are shown on pages 3 and 4.

Sampling procedures

To estimate populations of soil pests, the sampling methods must be practical and the estimates of densities must be reliable. For soil insect pests living in the top 2 to 4 inches of soil, roots, or other plant material, a square foot sample 4 inches deep is adequate. This method works for root weevils, flea beetles, clover root borer, mint root borer, sod webworm, and most subterranean cutworms. In other situations, core samples about 6 inches in diameter, including the plant roots, should be taken to a depth of about 8 inches to 12 inches for wireworms and symphylans.

Most of these soil and root pests are concentrated in a few areas within a field. Therefore, it is important to take enough samples to be representative of the

field and to identify "hot spots." When "hot spots" are located, sample more intensively to determine their extent.

The number of soil samples needed will vary with the pest, the crop, and the size of the field. Usually one to three samples per acre can provide an estimate of a soil pest population. For example, a minimum of 30 soil samples should be taken to estimate densities of symphylans in a 10-acre field. As field size increases, fewer samples per acre usually provide an adequate pest population estimate (60 samples for a 40 acre field). Take samples at random to obtain an unbiased estimate of the population. Dividing each field into blocks and taking random samples will provide the best estimate of the population. For convenience, the field should be visually divided into acre-sized blocks, and soil samples should be taken from each block.

Densities of soil pests vary during the year, so soil samples should be taken when peak densities occur. Figure 4 shows the time of year when soil samples should be taken for the most common soil pests.

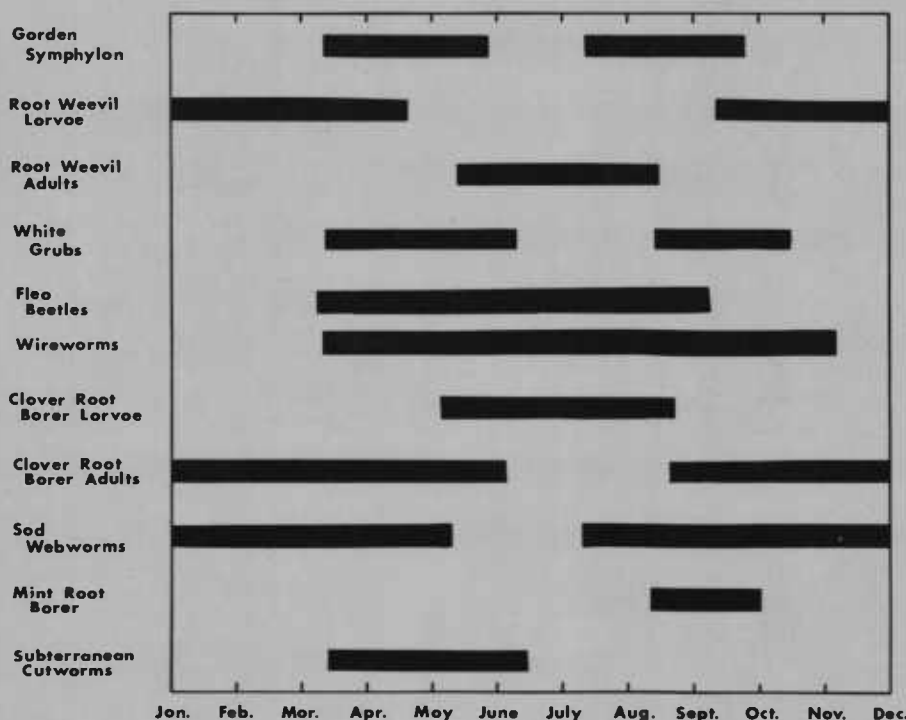
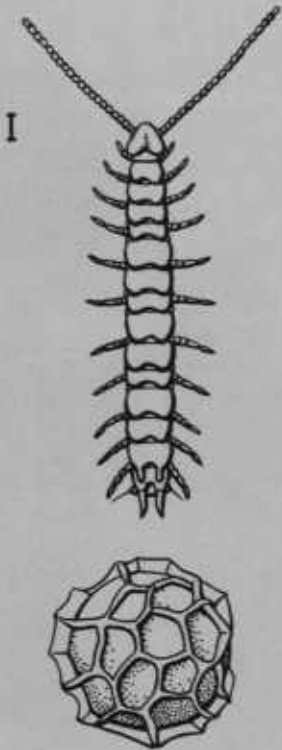
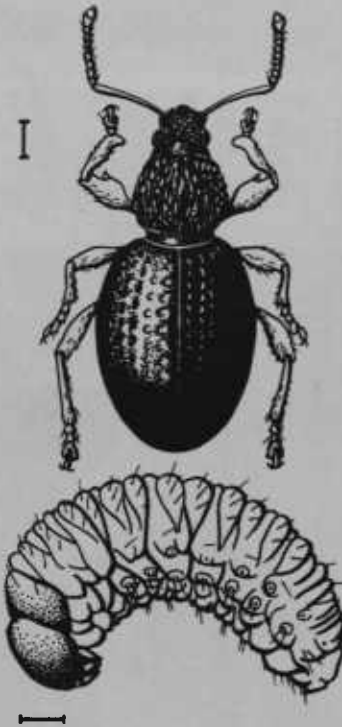


Figure 4. Time of year to take soil samples.

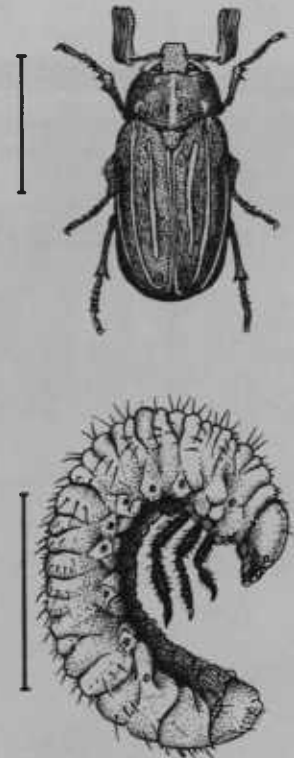
Some Common Soil Arthropods Found in Soil Samples



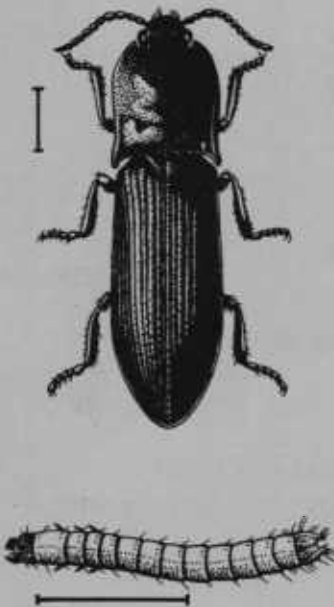
Garden Symphylan and Egg



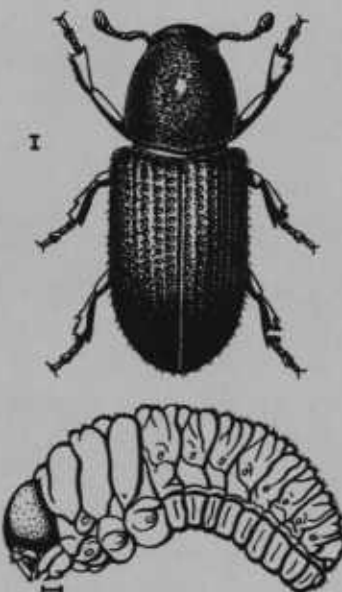
Root Weevil Larva and Adult



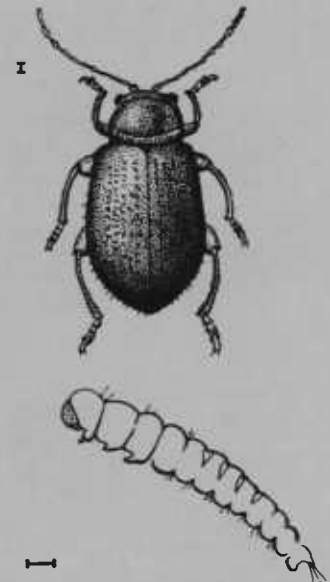
White Grub Larva and Adult



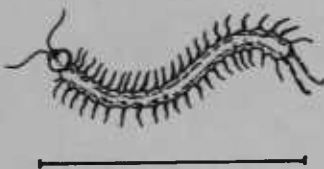
Wireworm Larva and Adult



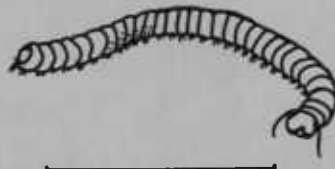
Clover Root Borer Larva and Adult



Flea Beetle Larva and Adult



Centipede

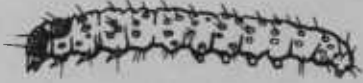


Millipede

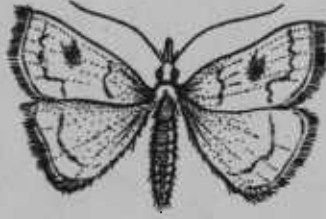


Dipluran

Some Common Soil Arthropods Found in Soil Samples (cont.)



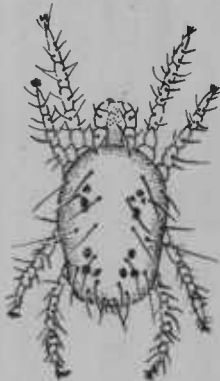
Sod Webworm Larva and Adult



Mint Root Borer Larva and Adult



Cutworm Larva and Adult



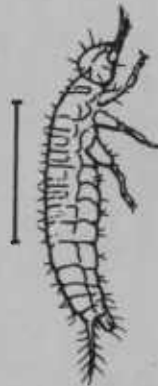
Soil Mite



Spring Tail (Collembola)



Rove Beetle Larva



Ground Beetle Larva and Adult