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A PORTABLE AND CONVERTIBLE "MOCZARSKI/TULLGREN" EXTRACTOR FOR FUNGUS AND LITTER COLEOPTERA

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ABSTRACT

A portable and convertible "Moczarski/Tullgren" extractor is described, illustrated, and compared with other Berlese apparatus used to extract arthropods from fungus and litter samples.

Berlese (1905) designed an apparatus for extracting arthropods from soil and litter that used a heated water jacket to force the animals from the sampled material. A modification of Berlese's apparatus that used an electric light bulb to heat and desiccate the sample from above was suggested by Tullgren (1918); this is the basic design in wide use today and popularly termed "Berlese apparatus," which we refer to here as the "Tullgren apparatus." Jacot (1932) designed a collapsible funnel that converted to a solar extractor. Many subsequent modifications of the Berlese-Tullgren idea have been described in the literature (*e.g.*, Murphy 1962*a*, *b*; Peterson 1964). Traditionally the devices were made of metal or wood, and were consequently bulky, heavy and difficult to move into the field, particularly in large numbers. The Tullgren apparatus, of course, is restricted in use to areas where electricity is available. While field-adapted Berlese or Tullgren apparatus have been developed that use alternative (fuel-) heat sources, they are generally expensive to construct and awkward to transport.

In 1910 Holdhaus described the "Ausleseapparat von Moczarski," a device for extracting litter arthropods that does not depend on any external energy source (and is, thereby, "passive" in action). Such apparatus were essentially cloth bags within which samples were suspended in open-mesh containers and allowed to slowly air-dry. Arthropods leaving the desiccating materials would fall to the bottom and be trapped in a manner similar to the Berlese and Winkler devices. An advantage to these Moczarski apparatus was their construction, which was of soft materials that were both light in weight and collapsible for ease of transportation. Furthermore, they can be used in the complete absence of electricity or fuels and are highly portable. There is also anecdotal evidence that they provide a more gentle extraction of arthropods that is particularly effective for certain taxa, and especially for larvae. Their disadvantage is the comparatively slow operation (hastened, of course, by use in areas of low relative humidity as, for example, within dwellings). These extractors are variously referred to as "separators" (Martin 1977), "photoeclectors" (Smetana 1971), "Moczarski's eclector," or "Winkler devices."

When we wanted to transport a large number of Tullgren funnels to the Appalachian Mountains to sample mycophagous and humicolous Coleoptera, we were faced with a common problem. How were we to get a sufficient number of these devices into the field? Also, how could they be used on those occasions when no electricity was available at a campsite? The purpose of this note is to report our solution to these problems.

We designed an extractor that converts quickly and easily from an electrically operated Tullgren apparatus to a passive Moczarski apparatus. It is portable and light in weight, yet offers the advantage of rapid extraction when time is constrained and electricity is available. As with previous designs, our extractor functions most efficaciously when used in conjunction with a sifter (Reitter 1911, Smetana 1971, Wheeler 1984).

Our device (Fig. 1) measures about 15″ square and 40″ high. Construction is of light weight rip-stop nylon fabric (hood and funnel) and "no-see-um netting" (mid-section). The shape is given by two 15″ square frames made of ⅛″ stainless steel rods. The apparatus is hung from strings tied in the four upper corners and gathered on a small metal ring. A sheet of ¼″ hardware cloth rests on the lower frame and is held in place by short pieces of soft wire stuck through the fabric and twisted. It is useful to place a layer of cheesecloth over the hardware cloth to exclude large quantities of dirt from the sample. The "funnel" is formed by four triangular pieces of the nylon fabric 15″ wide along the edge sewn to the frame, and about 18″ long on sides that taper toward the bottom. All four ends are sewn onto a small metal ring about 1″ in diameter. The ring fits snugly into the mouth of a 6-oz. "Whirl-Pak®" plastic bag. The bag holds a liquid preservative into which the arthropods are collected. We used 70% ethanol, but some will prefer other formulations, such as acetic alcohol or Barber's fluid that may keep specimens less brittle. Another alternative is to use damp pieces of cloth or paper towels for catching living specimens.

In the Moczarski apparatus (passive) mode (Fig. 1, left), litter is simply placed on the hardware cloth. Alternatively, the litter can be placed in bags approximately 15″ wide × 12″ tall × 2–3″ thick made of open weave material. These can be suspended from two opposing sides of the upper frame (we installed extra parallel rods for this purpose in some of our apparatus), and have the advantage of increasing the amount of surface area and thereby expediting the desiccation process. The large size of our devices (15″ square compared to the usual 12″ size of Tullgren apparatus and some Moczarski devices), however, mitigates the necessity of using these inner bags. Another factor, of course, is that the light weight of our design allows the transport and use of larger numbers of them. The device is easily converted to a Tullgren apparatus (Fig. 1, right) by rolling down the upper sleeve and placing an aluminum lid-reflector over the upper frame from which a light bulb is suspended over the sample. We have found that the operating time of the apparatus is simply manipulated by varying the length of the electric cord beneath the lid (and thereby the height of the lamp above the sample). This is useful when time constraints or moisture content of samples dictate a more rapid extraction of the sample. Our design permits moisture to rapidly escape through the no-see-um netting, adding to the speed of operation in either mode.

The modified apparatus described here is useful because it combines the principles of a passive Moczarski separator and a Tullgren apparatus in a single device that is collapsible. We have found the devices useful both in the field and in the laboratory, under the former circumstances because they can be

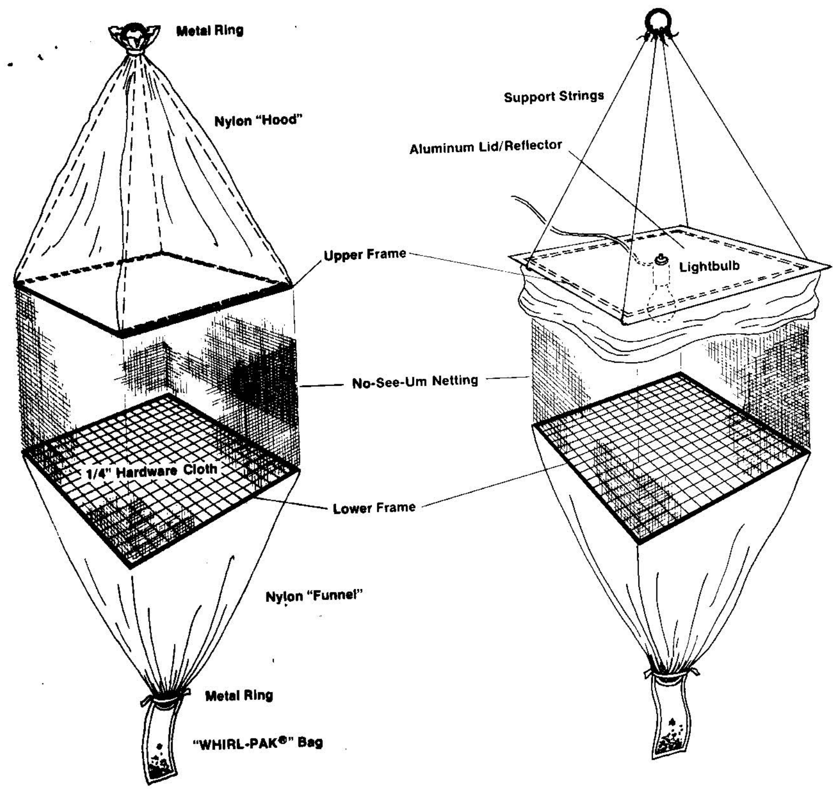

Fig. 1. Modified Moczarski-Winkler/Berlese-Tullgren apparatus showing design and parts: (left) Moczarski "mode," (right) Tullgren "mode." See text for discussion.

transported and operated in large numbers under less than optimal conditions (and with or without electricity), and under the latter because they require little storage space yet provide funnels of large capacity for litter extraction.

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