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A Portable Vacuum for Collecting Arthropods From Drop Cloths

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Abstract

A hand-held vacuum modified for collecting insects and spiders in the field is described. The vacuum with battery is mounted on a lightweight pack-frame and is portable and versatile. It is especially useful for collecting arthropods that are dislodged from foliage samples and drop onto cloths.

Keywords: Field equipment, sampling methods, insect populations.

Forest defoliators are often sampled by beating foliage over a drop cloth and counting the dislodged larvae that fall on the cloth. Foliage beating also affords an opportunity to examine associated arthropods that drop off the branch at the same time. These are usually other insects and spiders, many of which may be predators of small defoliating larvae. Because a variety of species and stages may be involved, these associates are best collected and examined later in the laboratory. Collection has to be quick, however, lest some individuals escape by flying or running off the cloth. A small portable vacuum modified for field use is an excellent tool for rapidly collecting selected specimens from a drop cloth.

The vacuum is a hand-held Black and Decker Car-Vac[1] powered by a 3-ampere, 12-volt electric motor. The suction opening in the front cover is made smaller by plugging the opening with a fitted wooden block and plaster of paris through which a 1/2-inch (12.7-mm) hole is bored (fig. 1A). Suction is through a 3/8-inch

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[1]The use of trade names is for the information and convenience of the reader only. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture of any product or service to the exclusion of others which may be suitable.

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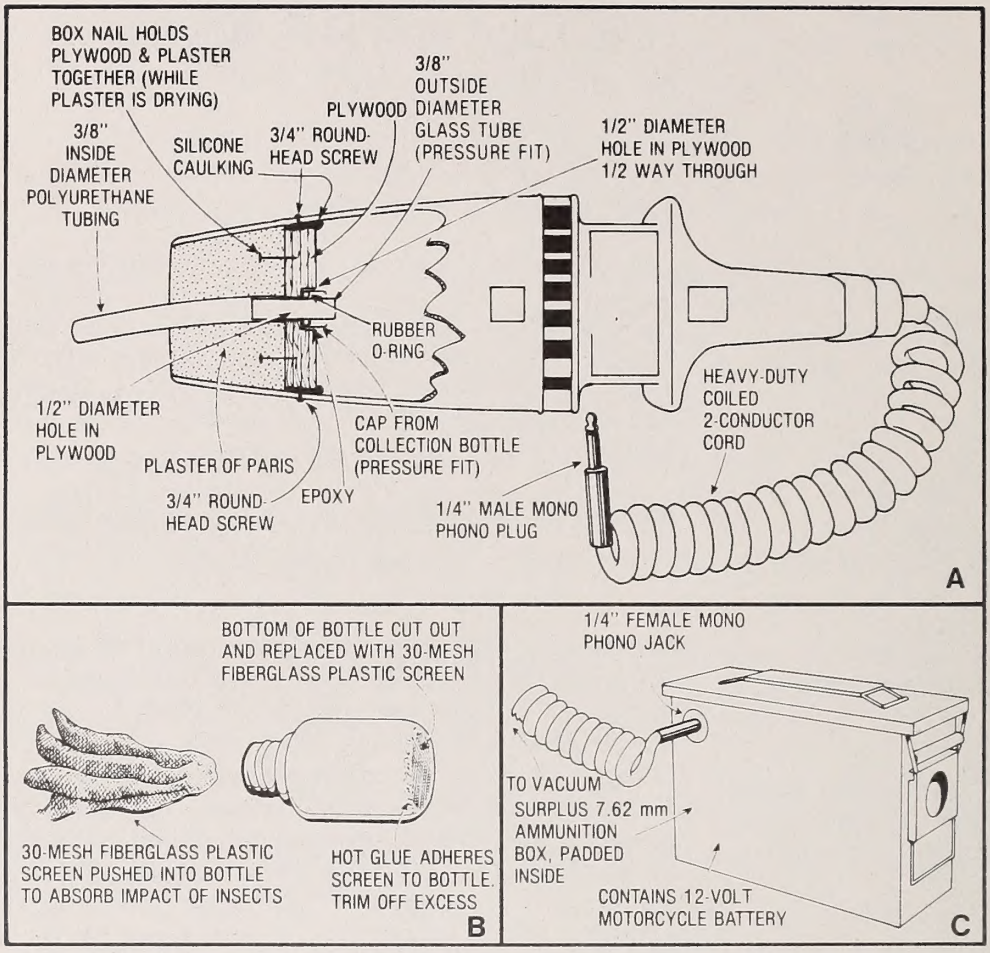

Figure 1.--Schematic diagram of modified Car-Vac: (A) vacuum with modification in the front cover; (B) collection bottle; (C) battery box.

(9.5-mm) flexible plastic tube that passes through the block and feeds into a collection bottle inside the cover. The bottle (fig. 1B) is screened on one end to permit airflow and threaded on the other so that it can be screwed into a cap countersunk on the inside of the block (fig. 1A). The small size of the suction tube permits selective vacuuming of individuals without sucking up large amounts of dry needles and other plant debris from the cloth. Because specimens are pulled through the tube with considerable velocity, a piece of fiber glass screen placed in the vial helps prevent damage to their soft bodies.

Power source for the vacuum is a 12-volt motorcycle battery carried in a padded surplus ammunition box. The box is fitted with a conventional mono plug for connecting the coiled, heavy duty electrical cord from the vacuum (fig. 1C).

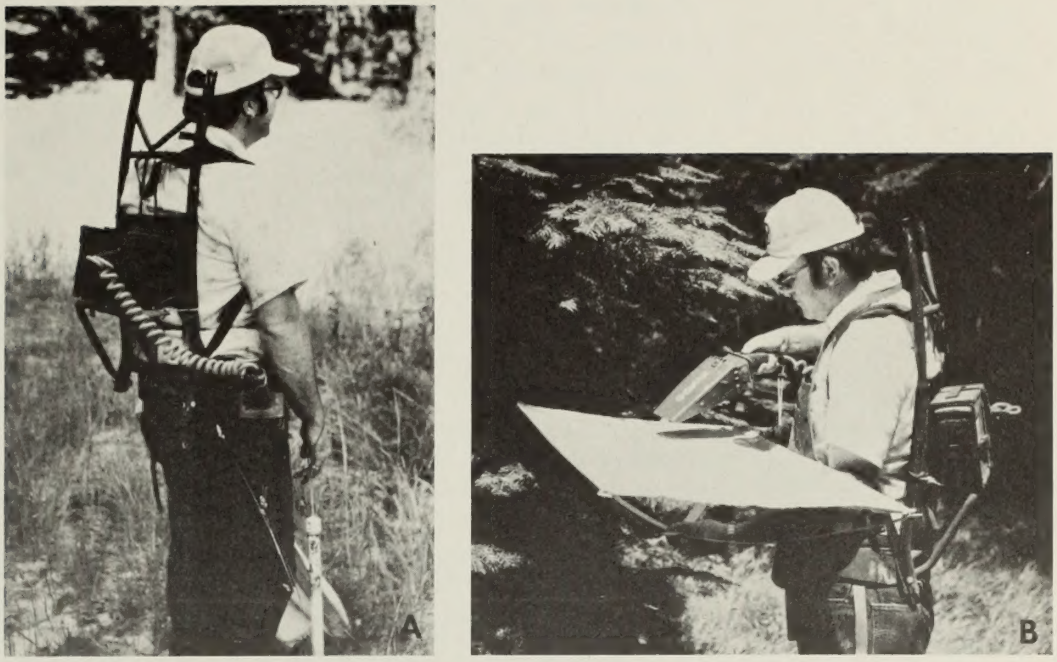

Figure 2.--(A) Pack-frame with mounted battery and side holster for vacuum; (B) collecting arthropods from beating cloth.

A lightweight, cargo-type pack-frame is used for carrying both the battery and vacuum in the field. The battery box rests on the frame's bottom support and is held in place by straps. The vacuum is carried in a side holster attached to the frame's web waist belt (fig. 2A). Weight of the entire unit is 20 pounds (9 kg). With this arrangement a person carrying the unit can operate the vacuum with one hand and have the other hand free to hold a beating cloth (fig. 2B). Under normal use, a fully charged batter will operate efficiently for 8 hours before needing recharging.

The equipment described here has been especially successful in collecting insects and spiders from the hand-held beating cloth described by Paul (1979). In our studies, 18- to 20-inch (45- to 50-cm) branches of true firs or Douglas-fir were sampled. With the cloth held underneath, the branches were vigorously rapped with a beating stick. All arthropods that dropped off were vacuumed into the collection bottle within seconds of striking the cloth (fig. 2B). We found that a single 1-ounce (30-ml) bottle usually accommodated the arthropods from 30 such branches. A full bottle is easily removed by unscrewing it from the vacuum and attaching a cap to prevent escape. The collection can then be preserved by dropping the whole bottle in a small jar of 70-percent alcohol. By slightly loosening the screw cap, the alcohol will quickly circulate through the screened end of the bottle.

Despite the narrow suction tube, some needles, bud scales, and other debris are inevitably collected and make separation of specimens in the laboratory more difficult. Arthropods can usually be separated from plant material by emptying the vial contents into a shallow pan of water. Because of their lighter weight, most arthropods float to the top where they can be easily screened off and preserved in alcohol.

We have used this equipment for 3 years to study arboreal arthropod communities in the Pacific Northwest and have had remarkably consistent results. For example, a typical sample of 150 fir branches (3 branches on each of 50 trees) yielded 8 to 10 arthropod orders--usually dominated by spiders (Araneae) (fig. 3). Because the foliage is systematically sampled, total numbers collected can also be translated into density values and the relative abundance of potential predators easily assessed.

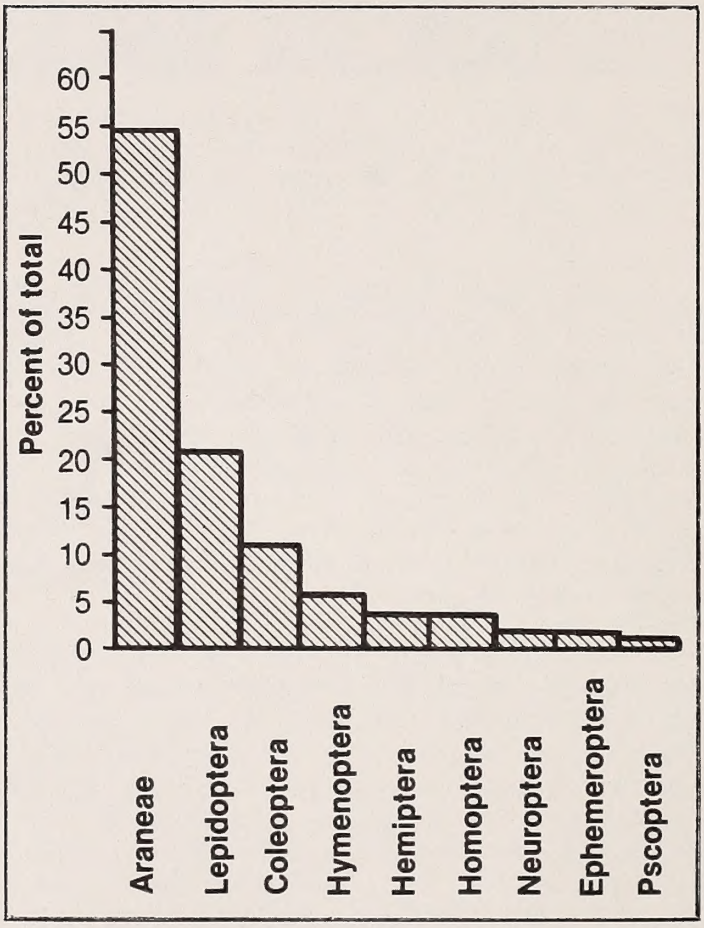

Figure 3.--Numerical composition of arthropods, by order, (sample size = 203) collected by beating and vacuuming the contents from 150 18- to 20-inch (45- to 50-cm) fir branches on a plot near Fort Klamath, Oregon.

Literature Cited

Paul, H.G. How to construct larval sampling equipment. Agric. Handb. 545. Washington, DC: U.S. Department of Agriculture; 1979. 11 p.