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A BATTERY-POWERED SLIDE IMPINGER FOR ULTRA-LOW VOLUME DROPLET SAMPLING

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ABSTRACT. A variation of the battery-powered slide impinger is described. The impinger uses a commercially available cordless screwdriver to rotate teflon-coated glass microscope slides for collection of aerosol droplets. The device is inexpensive and easy to construct.

The effectiveness of ultra-low volume (ULV) application of insecticides for mosquito control was demonstrated more than 20 years ago (Mount et al. 1968). This effectiveness depends directly on the droplet size produced by the ULV generator (LaMer et al. 1947; Yeomans 1949; Mount 1970; Mount and Pierce 1972a, 1972b; Lofgren et al. 1973). The sampling of droplets should be simple, rapid, inexpensive, and repeatable, and minimize the exposure of the user to the insecticide (Peterson et al. 1978). Several investigators have reported that the settling chamber was the most accurate method of sampling droplets (Rathburn 1970, Mount and Pierce 1972a, Carroll and Bourg 1979). Brown et al. (1990) demonstrated that there was no significant difference with respect to volume median diameter among 6 different methods (vertical swing, complete diagonal swing, top diagonal swing, impinger, pendulum, setting chamber) for sampling aerosol clouds. The complete diagonal swing and the impinger had the lowest variability over distance.

With the intent of further improvement and given the cost of commercially available impingers (e.g., Hock impinger, $110) we constructed a battery-powered slide impinger that could be easily operated and inexpensively made (i.e., $45) from readily available materials. The cordless screwdriver Skil Twist Xtra™ (Chicago, IL) was chosen because of size, detachable rechargeable battery pack, and speed of rotation (180 rpm).

The impinger (Figs. 1A, 1B, and 1C) consists of a swing arm, cordless screwdriver, and battery pack. The swing arm (Fig. 1A) consists of ¾-in. (19-mm) polyvinylchloride (PVC) (schedule 40) pipe 24 in. (60.9 cm) long with a ¼-in. (6.35-mm) hole drilled in the center to accept the ¼ × 3-in. (6.35 × 76.2-mm) bolt that serves as the axis. The axis bolt is secured to the swing arm with a lock nut. Electrical tape covers the threads of the axis bolt to provide a tight fit into the screwdriver. The ends of the swing arm have ½ × ¼-in. (12.7 × 6.4-mm) stove bolts that attach ¾-in. (19-mm) binder clips. Slides are held upright by these clips and rubber bands (Fig. 1A) attached to the handles of the clips. The

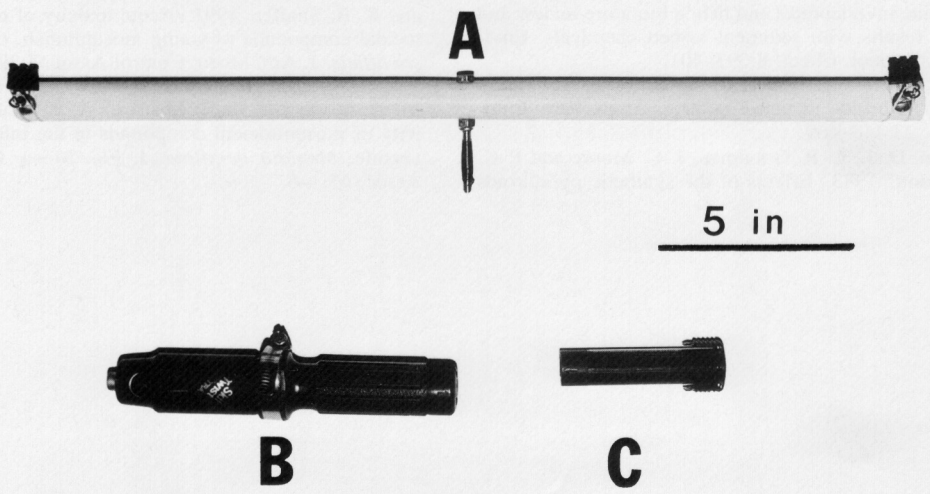

Fig. 1. Component parts of the battery-powered slide impinger: A—swing arm, B—cordless screwdriver, and C—detachable rechargeable battery pack.

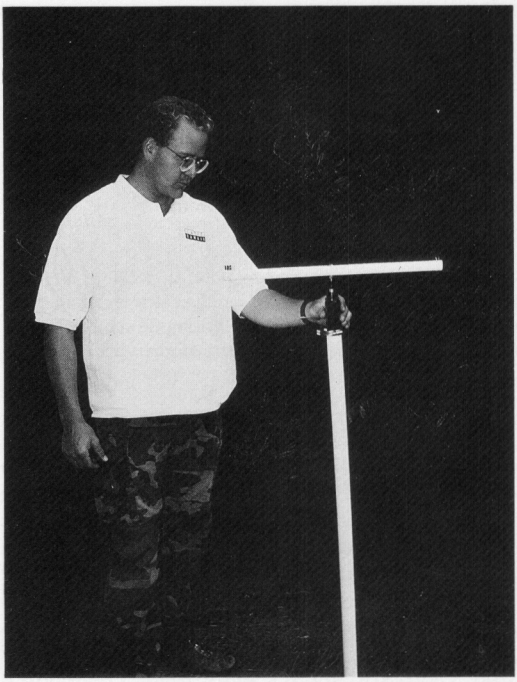

Fig. 2. Slide impinger being placed in support stand.

cordless screwdriver (Fig. 1B) can be set to operate either forward or reverse. However, the teflon surface on the slide must be traveling forward for successful operation. A ⅜-in. (9.5-mm) nut with a 3-in. (76-mm) hose clamp is used to hold the trigger in the on position. The impinger will start immediately when the battery pack (Fig. 1C) is inserted into the screwdriver. Because the impinger has a 1-ft. (304.8-mm) radius of rotation, it should be held at arm's length before putting the battery in place. With a fully charged battery the impinger will turn for a minimum of 20–30 min, so that the droplet sampling could be done several times if necessary before the battery needs to be recharged.

The handle of the screwdriver (Fig. 2) fits inside 1¼-in. (31.75-mm) PVC (schedule 20) pipe, which if driven into the ground (or otherwise held upright) will serve as a support stand. The impinger can be turned on and placed in the stand (PVC pipe), allowing the user to move away from the impinger and reduce the amount of exposure to the pesticide. This also leaves the user free to record any other information needed during sampling. The impinger weighs 681 g (including battery); there is slight centrifugal force when the battery is put in place, with little or no vibration during operation. This impinger has been used during the past 2 years for determining droplet volume median diameter of aerial applications. Droplets were collected from Biomist®, Cythion® ULV, and Scourge®. Volume median diameters were within the prescribed label requirements for the type and rate of application.

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