An Inexpensive Collapsible Pyramidal Emergence Trap for the Assessment of Wetland Insect Populations

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ABSTRACT: A design for an inexpensive collapsible pyramidal emergence trap is discussed. Each emergence trap can be fabricated for less than $12 in materials and in less than one hour. The trap presented here provides a cost effective and efficacious design for sampling mosquitoes, such as *Culex erythrothorax*, that are associated with emergent macrophytes and are difficult to sample as larvae.

INTRODUCTION

Mosquito abundance and estimates of mosquito production from wetlands can be greatly underestimated by dip samples. *Culex erythrothorax* Dyar and other species that inhabit densely vegetated marshes and wetlands generally represent a low porportion of individuals in dip samples; whereas, they can constitute the majority of adults collected in carbon dioxide-baited suction trap samples (Walton and Workman 1998, Workman 1998). In addition to adult mosquitoes developing from hyponeustic immature stages, emergence traps also can be used to sample adult production from benthic insects, such as chironomids (Diptera: Chironomidae), and plant-dwelling insects, such as Odonata and Ephemeroptera.

In order to obtain representative samples from the different regions of large wetlands or from replicated experimental wetlands, it was necessary to use a large number of emergence traps. An inexpensive design which required minimal fabrication time was desirable. The present paper includes a description of a collapsible emergence trap.

MATERIALS AND METHODS

Emergence traps were designed to sample an area equal to 0.25 m2 (Figure 1A and B). Traps were constructed from pine furring strips (stock size: 0.025 × 0.05 × 2.4 m [1" × 2" × 8']) and pine board (stock size: 0.025 × 0.15 × 2.5 m [1" × 6" × 8']). Furring strips were cut to two lengths: 46 cm (vertical support: 18") and 58 cm (horizontal crosspiece: 22.75"). A radial arm saw was used to cut an angle of approximately 23o on one end of each 46 cm piece. In order to accommodate joining the sloping sides of the trap to a horizontal crosspiece, a right- or left-handed complex angle (23o and 25o) was cut on the opposite end of each vertical support. The top assembly of the trap was fashioned by joining two 14 cm × 14 cm (5.5") cuts from the pine board after a 7.6 cm (3") hole was drilled through the bottom section and a 10.2 cm (4") hole was drilled through the upper section using hole saws. The two sections were fastened using four 3.2 cm (1.25") drywall screws.

In order to collapse the trap (Fig. 1C), each horizontal crosspiece was drilled at 1.9 cm (0.75") on center from both ends. Wooden dowels (0.64 cm diameter × 3.8 cm long [0.25" diameter × 1.5" long]) were glued into half of the horizontal crosspieces. Hinges (3.8 cm [1.5"]) were attached to the top of each vertical support and to the lower section of the top assembly, and then each horizontal crosspiece containing dowels was affixed to the vertical supports using drywall screws. The outside edge of each vertical support was offset 1.9 cm (0.75") from the dowel to allow placement of a horizontal crosspiece onto the dowel.

Collection jars were 0.5 L (16 oz) wide-mouth canning jars (Kerr® or Ball® jars: Alltrista Corp., Muncie, IN). A plastic funnel (80 mm diameter, #10-348-B; Fisher Scientific, Pittsburgh, PA) was inserted into each jar. The 80 mm funnel causes the screw top on the jar to be closed with difficulty; a newer model 79 mm funnel (#10-348-2B) may provide a better fit. The 10.2 cm (4") hole in the top assembly holds the collection jar. Additional support for the jar can be provided by inserting two cup hooks on either side of the jar and then rotating the hooks to come in contact with the exposed threads on the lip of the jar or with the crimped edge of the metal lid.

Rolls of fiberglass window screening (91 cm [36"] wide) were cut in half and then dimensions were marked using two templates. Duplicate screens of two sizes [(upper length × lower length × height) 14 cm × 53.5 cm × 46 cm or 14 cm × 61 cm × 46 cm] were affixed to the wooden frame of each trap using a staple gun.

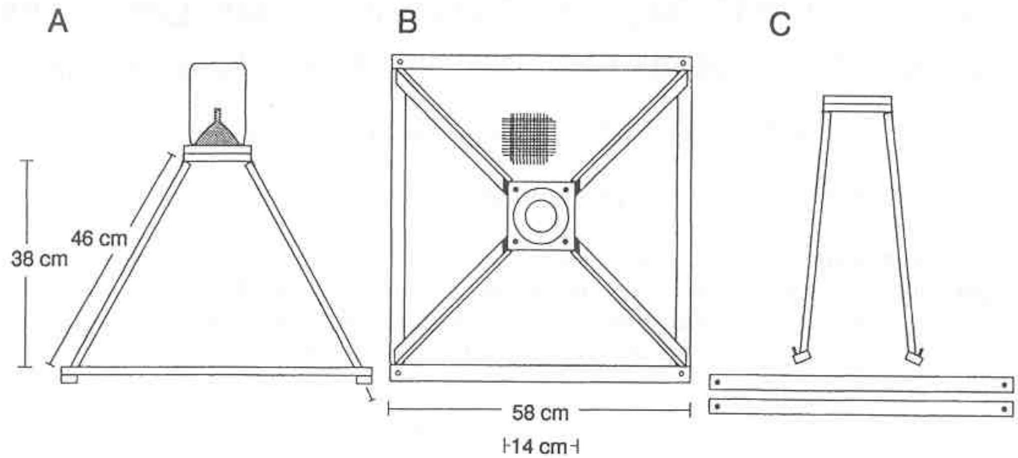

Figure 1. Different views of the Riverside emergence trap. Side (A) and overhead (B) view of an expanded trap. Side view (C) of a collapsed emergence trap.

RESULTS AND DISCUSSION

Pyramidal emergence traps of several basic designs have been used to study mosquitoes emerging from a variety of permanently and intermittently inundated habitats (Service 1995). The trap described here combines the features of previous designs (Aubin et al. 1973, Slaff et al. 1984) to sample a potentially large number of emerging insects from treatment wetlands receiving enriched wastewater. The trap can be folded when space for transport to field sites is at a premium and set up easily in the field.

The Riverside emergence trap can be produced inexpensively and quickly within a modestly supplied wood shop. The cost of materials was $11.60 per trap (1997 dollar values) and 45 minutes labor was required to fabricate each trap. The cost per trap can be reduced further by substituting plumber's tape for the hinges. The hinges were the most expensive component of the trap ($1.10 per hinge). If space is not limited for transporting traps to field sites, then little advantage in space savings is gained by folding the traps as compared to stacking unfolded traps. Permanently affixing the corners of the horizontal crosspieces with drywall screws eliminated the need for a minimal expense ($4.20) and labor (installation and maintenance/replacement) associated with the dowels.

We found that adding a 15.2 cm (6") screen skirt to the horizontal crosspieces appreciably reduced the likelihood that emerging insects could escape from the trap and prevented insects not derived from below the trap from entering when water depth fluctuated. The skirt was attached to the horizontal crosspieces with staples and the free ends were sealed using a hot-glue gun. The skirt can be folded into the trap during storage and transport. Floats (e.g., styrofoam, FunNoodles®) can be attached using cable ties to the base of trap for use in comparatively open water habitats and a pair of cup hooks ($0.11 each) can be added to secure the jar on top of the trap. Three persons can fabricate nearly 100 traps in approximately 3-4 days.

This emergence trap has been used to study the spatial and temporal patterns of wetland mosquito production (Walton et al. 1998), the efficacy of control measures against mosquitoes developing in dense vegetation (Walton et al. 1998) and the effects of vegetation management practices on mosquito production (Walton et al. 1999). The trap presented here provides a cost effective and efficacious design for sampling mosquitoes, such as *Culex erythrothorax,* that are associated with emergent macrophytes and are difficult to sample using a dipper.

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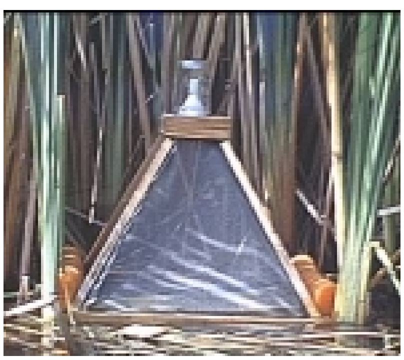

N.B. We have made further alterations to the design. You can save money by using plumber's tape instead of the hinges. The traps made with plumber's tape are a bit less durable than those made with the hinges. We also have used nuts and bolts on the 4 bottom corners to increase the sturdiness of the trap. Last, we used cable ties to affix FunNoodles® to float the traps; this was needed to carry out open water vs. vegetated zone comparisons.