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OPERATIONAL NOTE

A SIMPLIFIED TRIPOD SUPPORT FOR USE WITH CARBON DIOXIDE–BAITED VECTOR SURVEILLANCE TRAPS

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ABSTRACT. A vector surveillance trap support was designed as a tripod of polyvinyl chloride pipes to suspend carbon dioxide–baited traps. This system offers several advantages, including increased ease of transport and trap placement at varied sampling sites, particularly in adverse environments not conducive to previous methods of support. Presentation of the simple design and manufacture of the tripod support is provided.

KEY WORDS Tripod support, vector surveillance, hanging traps, carbon dioxide, mosquito trap

Carbon dioxide (CO_2) emission is common to all vertebrates and consequently is a ubiquitous kairomone that attracts hematophagous Diptera (Takken 1996). The addition of a CO_2 source to mosquito traps significantly increases catch counts and total number of target species sampled (Newhouse et al. 1966, Meeraus et al. 2008, Farajollahi et al. 2009). Because of the success of this particular lure, many common trapping methods currently used in the field include a CO_2 component, often through the use of a dry ice container, hung near the opening of a trap. A variety of hanging mosquito traps may be baited with CO_2, including the Encephalitis Virus Surveillance trap (BioQuip Products, Rancho Dominguez, CA), Mosquito Magnet® X trap (Woodstream Corporation, Lititz, PA), and the Centers for Disease Control and Prevention miniature light trap (John W. Hock Company, Gainesville, FL). The mobile nature of vector surveillance in the field dictates that all of these traps are of a similar lightweight design (<2 lb or 1 kg) and are typically provided with a CO_2 source. This is supplied by a suspended container of dry ice (~5 lb or 2 kg) or via a tube from a gas cylinder that can be placed on the ground.

A structure for support is necessitated by these widely used traps at each surveillance location, because they require suspension above the ground. Traps are typically set in areas where such a structure (manmade or natural, such as branches of suitable strength at a manageable height) is present and can be utilized for this purpose. In 2005 Evans et al. proposed the construction and use of a T-shaped support pole that could be erected where no apposite vegetation was present, by driving its pointed aluminum tip into the available substrate. We describe a simpler design for a tripod trap support that is easily manufactured, cost efficient, and readily transportable and may be placed on top of a variety of substrates (including concrete and asphalt).

The tripod trap support is fabricated from 1¼ in. (3.2 cm) schedule 40 grade polyvinyl chloride (PVC) pipe, cut to 3 identical 80 in. (2 m) lengths. Subsequently a ⅜ in. (1 cm) hole is drilled through each length at 1½ in. (3.8 cm) from one end, and a 14 in. (36 cm) black double-lock cable tie (tensile strength 75 lb or 34 kg) is then looped through the holes of all 3 lengths and pulled tight, securing the 3 lengths together (Fig. 1). To set the tripod support, the unfixed ends of the PVC lengths are spread 3–5 ft (0.9–1.5 m) apart, and the trap with dry ice is hung from the protruding fixed ends at the top of the tripod, as shown in Fig. 2.

The versatility of this design allows placement of traps on practically any terrain, including anthropic surfaces in urban environments and sandy or dry compacted substrate, because it does not have to be driven into the ground or placed into a concrete block necessitated by the T-shaped support. A support that suspends mosquito traps allows greater flexibility of site choice and trap positioning, because specific locations can be chosen where no suitable vegetation or structure is available to place the trap. The ability to sample populations in all geographic environments is critical to mosquito surveillance and control efforts, because selective methods of sampling can skew results and incorrectly assess the risk posed by a vector population. Moreover, it is often in urban and suburban settings where there is the greatest potential for epizootic or epidemic spread of vector-borne disease, notably

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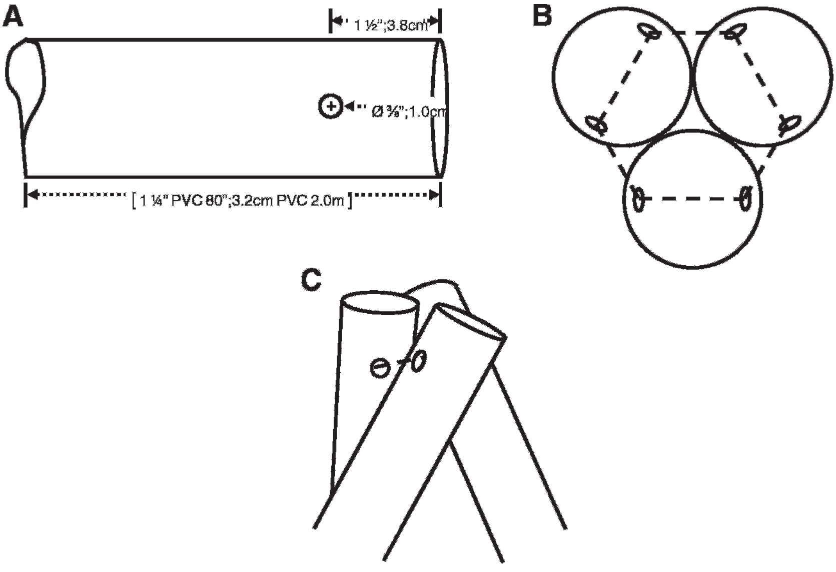

Fig. 1. Diagram detailing tripod support design. (A) PVC pipe design. (B) Top-down view of collapsed support. (C) View of splayed support. Solid lines depict PVC pipes and holes; cable tie as dashed line.

Fig. 2. Vector surveillance tripod support for use with CO_2-baited traps. A CDC miniature light trap is shown with its dry ice CO_2 source.

by *Aedes aegypti* (L.) and *Ae. albopictus* (Skuse) (Braks et al. 2003, Delatte et al. 2008, Farajollahi and Nelder 2009) and West Nile virus vectors (Brown et al. 2008). The support also potentially eliminates random differences between samples inherent to previous methods reliant on vegetation; such variables include interference of nearby foliage to the trap's suction and CO_2 or other attractant plumes, precise height above the ground, and variations in the micro-environment (e.g., amount of shade and proximity to particular structures). Furthermore, the tripod design comfortably fits in a typical surveillance vehicle (e.g., a standard pickup truck), because it is intrinsically collapsible, portable, and lightweight at less than 5 lb (2 kg), yet it effortlessly accommodates a hanging weight of 5–10 lb (2–5 kg).

The two materials and minimal equipment necessary for construction are commonly found in most hardware stores. The cost of the materials was under $15.00 USD, priced on average at 2 nationwide hardware stores ($4.71 for 10 ft or 3 m of PVC pipe and $11.47 for 100 wire ties, or 11 cents/tie). However, suitable scrap PVC pipe could readily be used in tripod support construction, significantly reducing the cost of manufacture. The time and labor involved in the construction of the tripod support are similarly minimal, and a specialist workshop is unlikely to be necessary for the construction of this support because PVC is a soft plastic that is easily cut and drilled. By adopting the strong and highly stable tripod structure in a trap support, metal reinforcement is obviated. Because of the low-cost and readily available materials used, as well as the simplicity of its construction, the tripod trap support offers a potentially universal means of providing consistent mosquito trapping methods across the USA and abroad. The adaptable character of this design readily permits trap placement in effectively any environment, notably on excessively loose or hard substrate. The authors speculate that other suitable materials could be utilized to construct the same tripod support (e.g., bamboo, cane, wood).

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