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OPERATIONAL NOTE

GLASS, RUBBER, AND NYLON: HOW TO MAKE A MOUTH ASPIRATOR ON A BUDGET FOR HANDLING ADULT MOSQUITOES

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ABSTRACT. A mouth aspirator with a bent glass tip was designed for adult mosquito collection and transportation. This aspirator has been utilized for mosquito laboratory and operational research in New Jersey for >60 years. We provide schematics and instruction for construction of this inexpensive and simple mouth aspirator, which offers improved maneuverability of handling adult mosquitoes from rearing cages in the laboratory and field application cages.

KEY WORDS Mouth aspirator, mosquito handling, adulticide efficacy trial

Mouth aspirators are commonly used for the collection and transportation of delicate arthropod samples, such as adult mosquitoes, and are often preferred over mechanical aspirators due to potential damage to fragile specimens and uncontrolled suction. Mosquito collection and manipulation techniques have undergone various instrumentation developments based on the particular needs of researchers, organizations, and individuals. For closed-environment applications and collection from traps or emergence chambers, a glass mouth aspirator (GMA) is most effective. The GMA has held a steady design for the past 60 years at Rutgers University in New Jersey, where it has been effectively used for various handling of adult mosquitoes. This tool is commonly used in mosquito laboratories and in the field, such as during adulticide efficacy trials. Simple to construct, a GMA can be a researcher's most basic yet most effective tool for collection and transportation of adult mosquitoes. Here we describe the straightforward fabrication of this long-established mouth aspirator design, which comprises 3 simple parts, can be constructed within minutes, and assembled for a substantially lower cost than manufactured aspirators from scientific supply companies.

Three common materials comprise the unit's 3 component parts: a mouthpiece made of flexible polyvinyl chloride (PVC) or rubber tubing, a collection chamber made from glass tubing, and a filter made of nylon stockings or pantyhose (Fig. 1). Rubber or PVC tubing of 8-mm (5/16-in.) external diam is the suggested material for use as the mouthpiece and is currently sold in nationwide hardware stores in units of 6.1 m (20 ft) for US$4.18. Clear glass tubing of 10-mm (3/8-in.) external diam is used for the collection chamber, which is currently sold by major scientific supply companies at $387.62 for 11.3 kg (25 lb) of standard wall glass tubing, providing 150 pieces of 122-cm (48-in.) glass tubing. The filter material is suggested to be nylon stockings, which can be easily purchased from neighborhood retail outlets such as pharmacies or at superstores for about $5.49 per package of 10 knee-high pantyhose.

The construction of the aspirator requires minimal labor and only the use of a razor blade, file, Bunsen burner (or other flame source), and needle-nose pliers. Generally, only a 41-cm (16-in.) section of the PVC tubing is necessary for the mouthpiece, which is easily cut to this length with a razor blade. Similar desired lengths could potentially be cut with comparable results. In order to cut the glass to its desired length of approximately 41 cm (16 in.), the glass is scored at least 4 times across its diameter at each point of where it should be cut with the file and then snapped off by firmly applying pressure to either side of the scored location. To eliminate any sharp edges, the flame from a Bunsen burner (a torch may also be used) should be used to smooth the edges. The next step with the cut glass tubing is to shape an angle in the tubing for improved maneuverability within cages and other collection or rearing containers of mosquitoes. A Bunsen burner or blowtorch is once again used for this purpose. If a torch is used, it does not need to be a premixed combination of fuel and oxygen model that is commonly used to melt glass and gives a much higher flame temperature. To create the bend, a section of the glass tube, about 10 cm (4 in.) from the tip, is exposed to the flame of a Bunsen burner or torch until the glass glows red from the heat. To obtain the proper angle while exposing the glass tube to the proper temperature, hand-hold the end furthest from the angle fixed while holding the other end with needle-

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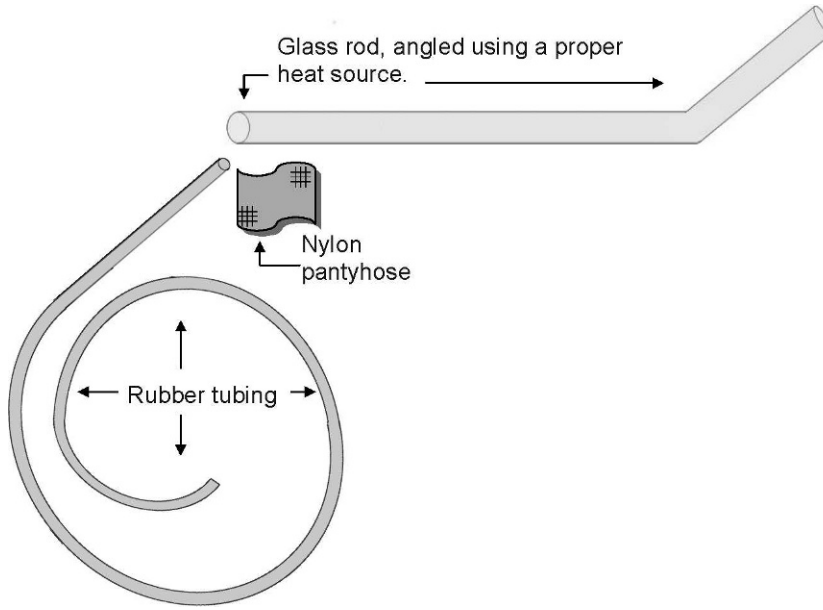

Fig. 1. Diagram depicting the materials used in construction of a glass mouth aspirator.

nose pliers. Ensuring the glass is hot enough to shape, gradually apply pressure and bend the glass tubing until the proper angle is reached (see Fig. 1). The glass only needs to be shaped to a 140° angle. To create the filter, a small section of nylon stocking or pantyhose is cut to a dimension of approximately 5 × 5 cm (2 × 2 in.), which is folded once over, slides over the PVC tubing, and is then inserted into the opening of the 10-mm glass tubing at the end furthest from the bend (Fig. 2).

The effectiveness and ease of use of the GMA described here is identical to that of commercially constructed mouth aspirators. The use of angled glass tubing in this design allows for easier positioning of the end of the collection chamber within adulticide cages used for pesticide efficacy trials and from other cages or containers to reach all corners of these areas where mosquitoes rest. This design offers a total unit cost of US$1.17 for each individual glass mouth aspirator, at $0.87, $0.28, and $0.02 for the glass tubing, PVC tubing, and nylon pantyhose, respectively. However, the cost of the glass tubing in particular yields a high initial cost if there is none already available in the laboratory or work area. Burton (1971) suggested the use of cut plastic or glass pipettes for this tubing. Kobylinski et al. (2007) suggest the use of supple tubing such as our PVC tubing as a substitute for the glass tubing to allow flexibility in tight spaces. Though the use of PVC tubing may work well with certain traps, this may prove difficult particularly with live samples in reaching far ends of a large cage or closer corners without requiring much handling to provide support of the collection tubing to position it, whereas stiff collection tubing as we suggest obviates this. Given the retail price of commercially available mouth aspirators is approximately $10.00 to $30.00, for the price of a single manufactured aspirator (~$1.00), one could custom construct several aspirators. This design additionally offers the advantage of cheap, easily replaceable filters, which are often difficult to remove, clean, and replace in retail aspirators. Other cheap, effective, and easily replaceable filters or barriers to prevent allergic reaction to scales and the inhalation of pesticides or other harmful particulates in certain applications have been suggested, such as the use of cotton plugs, condoms (Tang 1996), commercial filters (Paquin and Provost 2010), or the use of a mechanical sucking procedure using one or more rubber bulbs (Brockway 1963).

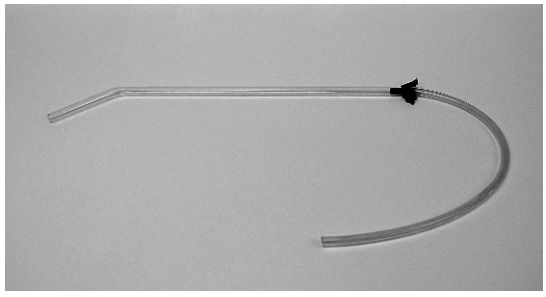

Fig. 2. Assembled glass mouth aspirator with angled collection tube.

This information is important for those seeking an effective and efficient means for aspiration of delicate adult mosquitoes while conducting oper-

ational or academic research. Mouth aspirators are an important tool in mosquito research, and custom-made mouth aspirators operate with the same effectiveness and are dependable for the same amount of time, if not longer, than that of retail mouth aspirators.

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