DESIGN FOR A CANOPY TRAP FOR COLLECTING HORSE FLIES (DIPTERA: TABANIDAE)

L. J. HRIBAR, D. J. LEPRINCE AND L. D. FOIL

Department of Entomology, 402 Life Sciences Building, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, LA 70803

ABSTRACT. A design for a canopy trap for collecting horse flies is described. The collecting heads can easily be changed since the collar is fixed in place and supports the trap. The collar allows an unobstructed pathway to the collecting head. The center pole has a sliding steel rod that allows adjustment of canopy height upon installation in one operation.

The use of canopy traps for collecting Tabanidae dates from Thorsteinson's (1958) development of the "heliothermal trap," which was shaped like an inverted cone with the clear plastic skirt supported by a tripod. Catts (1970) radically redesigned this trap by changing its shape from an inverted cone to a pyramid with a clear top and black bottom. Instead of being supported by a tripod, the trap was suspended from a rigid center pole, and the corners of the skirt were tethered to stakes in the ground. The supporting collar was attached to the center pole by a pair of stiff wires, bent into small, tight loops. The canopy trap of Adkins et al. (1972) consisted of a clear plastic pyramid, a supporting collar held to the center pole by 2 crossed bolts inside the collar and a collecting head that was attached by springs. The center pole was adjusted by means of a series of holes drilled through 2 telescoping pieces of electrical conduit. A wing nut and bolt held the center pole at the desired height. We present a design for a collecting head and a center pole that eases the operation of canopy traps, incorporating improvements developed during the last 10 years at the Louisiana State University Agricultural Research Center. All materials were purchased from local hardware stores, with 3 exceptions. The aluminum pipe and extruded acrylic tube were purchased from industrial suppliers, whereas the funnels were purchased from a scientific supply company.

Support ring and compatible collecting head: Aluminum pipe (14.1-cm O.D., 0.66-cm wall thickness, 12.8-cm I.D.) is cut into 7.6-cm high rings, and electrical conduit is cut into 15-cm lengths. One end of the electrical conduit (3.5 cm) is flattened in a bench vise. A 0.79-cm hole is drilled 2.5 cm from the edge of the aluminum ring. An identical hole is punched 1.5 cm from the edge of the flattened end of the electrical conduit. The conduit is attached to the inside of the aluminum ring with a bolt, flat washer, lock washer and hex nut.

Extruded acrylic tube, plastic funnels ("High speed PMP," 196-mm top diameter, Fisher Scientific Company), hot glue and liquid epoxy are used in the construction of the collecting head. The acrylic tube is cut into desired lengths with a soldering iron. The funnels are cut to fit inside the tube and glued into place with hot glue, after roughening the last 2.0 cm of the outside of the funnel and the inside of the tube. Liquid epoxy is poured between the tube and the funnel to reinforce the seal and produce a uniform smooth surface. After the glue and epoxy dry, a hot probe is used to melt small holes in the funnels above the level of the epoxy to allow water to drain from inside the head. Collecting heads can be modified to collect live horse flies by cutting holes in the sides of the acrylic tube with a soldering iron and covering them with screen. The top of the collecting head can be covered with polyethylene plastic or plastic bags secured with rubber bands.

Center pole: The center pole is made from galvanized pipe, steel rod, hex nuts and carriage bolts. A 0.79-cm hole is drilled through the pipe 9 cm from one end. A hex nut is welded over the hole, taking care that both holes are aligned concentrically. Two beads are welded on the steel rod, one 6 cm from the end, to prevent the rod from sliding down into the pipe, the other 80 cm from the base of the galvanized pipe. The bolt is bent into an "L"-shape, and threaded into the nut. The bolt serves to hold the rod at the proper height inside the pipe and allows height adjustment of the pole.

Skirt: Black "Tee-shot" poplin and nylon screen are used to construct the skirt. The screen is cut into trapezoids measuring 15.24 cm along the top margin, 106.7 cm along the bottom mar-

gin and 81.28 cm high. The poplin is cut into trapezoids measuring 106.7 cm along the top margin, 2.15 m along the bottom margin and 76.2 cm high. After the screen and poplin have been cut to size, they are sewn together with heavy duty nylon thread. A modified flat-felled seam was devised to avoid distal margins and to allow the skirt to be turned inside-out when the outside color starts fading. The modified flat-felled seam also prevents flies from being caught in distal margins of sewn pieces when they are facing inside the trap. One screen piece is sewn to one poplin piece, making one side panel of the trap. Four such panels are sewn together to form the pyramidal trap. A rectangular "tongue" is made from 4 layers of 4.0- × 10-cm poplin. One tongue is sewn to the end of each corner of the pyramid and reinforced by several seams. Brass grommets are attached to the poplin near the end of each rectangle. Nylon rope is cut in lengths of 2 m and is secured in the grommets and slides (7.6-cm × 2.5-cm × 9.5-mm marine plywood with two 0.5-cm holes drilled 1 cm from each short edge) used to tighten the guy ropes. The screen end of the skirt is attached to the outside of the support collar with a hose clamp. The clamp should be placed under the head of the bolt, 2-3 mm near the bottom margin of the collar, to prevent flies from being caught between the screen and the collar.

Assembly: The adjustable center pole and collecting head allow the traps to be erected by one person. The trap is first placed flat fully extended on the ground with ropes stretched. Pegs are driven 60 cm from the distal end of the rope with the rope looped around the pegs. The center pole is inserted under the canopy in the galvanized pipe; the height of the canopy is adjusted to knee level with the steel rod and carriage bolt. Then the ropes can be adjusted without difficulty to stretch the bottom of the canopy. Placing the grommets in a cloth tongue rather than in the corners of the trap allows for a more uniform tension to be placed on the fabric, and allows the trap to be set up with no sagging of the canopy. The funnel end of the acrylic collecting head is inserted into the support collar; the flattened electrical conduit supports the collecting head.

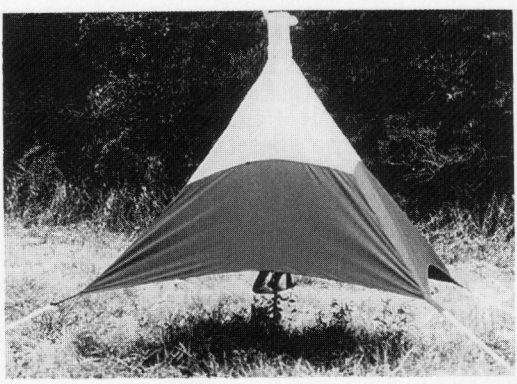

Fig. 1. Canopy trap in operation.

The height of the canopy is easily adjusted with the sliding rod inside the pole. The base of the center pole can be placed on a support when traps are used in sand or wet soil. The sliding rod design of the center pole also allows the trap height to be adjusted quickly after several days without disassembling the trap. The center poles also can be fitted with receptacles vials to hold vials of liquid attractants. Horse flies have an open access to the collecting head as no transverse piece of metal obstructs the inside of the collar. The collecting head is light, durable and takes up very little space. The collecting heads are easily removed and replaced on the traps without the need to secure springs or wires, allowing collections to be made rapidly and minimizing the effect of human presence near the traps. Operation of these traps during severe weather has shown that the head-support ring system is stable; the heads remain on the traps even in high winds.

Traps made with the poplin-screen skirts have been used in Louisiana for a decade at an average of 50 trapping days per year. They are durable to weather and fairly rough handling and require little or no maintenance. In subtropical areas like Louisiana, black poplin and screen are preferred materials to minimize excessive heat. When the black poplin begins to fade the skirt is inverted and the traps reassembled. Traps constructed according to this design are compact, occupying only 5,748 cm^2 and weighing only 1.95 kg (without poles, pegs and collecting heads) and can be constructed for a cost/unit of $61.52. A complete set of plans, including figures and a list of materials, is available from the authors upon request. The fully assembled canopy trap is shown in Fig. 1.

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