A MODIFIED PYRAMIDAL EMERGENCE TRAP FOR COLLECTING MOSQUITOES[1]

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ABSTRACT. An emergence trap that incorporated features from several prior designs was tested for collection efficiency in both laboratory and field trials. Compared to the baffle traps commonly used to capture emerging insects, the sticky trap collected 2.5–3.0 times the number of mosquitoes in all tests. The sticky trap was also approximately half the cost of the baffle trap and could be fabricated more easily.

INTRODUCTION

Emergence traps of many designs have been used to sample populations of eclosing adult insects (Service 1976). These traps do not generally disrupt the habitat greatly and are very useful in areas of limited access. Larvae of *Mansonia titillans* (Walker), *dyari* Belkin, Heinemann and Page and *Coquillettidia perturbans* (Walker) attach to plant roots for oxygen, making accurate estimation of their populations difficult (Bidlingmayer 1954, Lounibos and Escher 1983). As a result, many workers have used emergence traps to sample these mosquitoes (Lewis and Bennett 1980, Allan et al. 1981, Lounibos and Escher 1983).

Although a variety of emergence trap designs have been described, most are similar to the pyramidal traps of Aubin et al. (1973) or Lesage and Harrison (1979). In these traps, mosquitoes must generally pass through a narrow opening or baffle into a collection chamber. This configuration is complex, and some investigators have instead employed adhesive materials to capture emerging adult insects. Armstrong (1941) used a large, stationary screened enclosure that had a plywood roof coated with a sticky material to sample *Cq. perturbans*. An unenclosed floating emergence trap has been described for the collection of chironomid midges (Mason and Sublette 1971). This device had a top constructed of clear plastic coated with an adhesive to catch the insects.

The trap described and tested in the current paper incorporates aspects of many earlier designs. Simplicity of construction, cost, portability and trapping efficiency were the guiding parameters used in making this unit.

MATERIALS AND METHODS

The modified trap (Fig. 1) retains the pyramidal base used in previous models. The top is a clear plastic sheet covered with an adhesive to capture emerging adult mosquitoes.

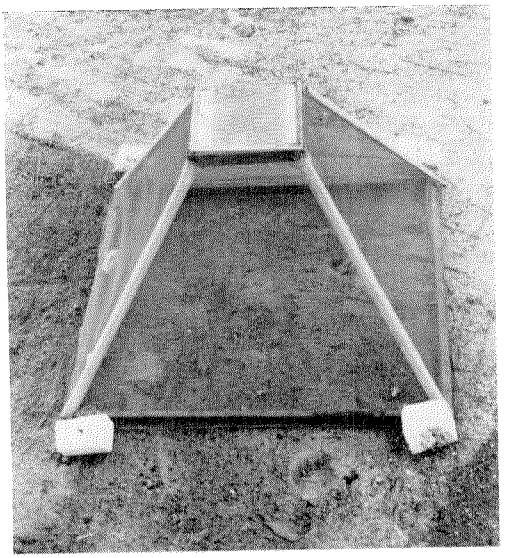

Fig. 1. Pyramidal emergence trap illustrating the plastic sticky top design.

The trap has a frame made with 1 in (2.5 cm) × 2 in (5.1 cm) wooden slats forming a base approximately 36 in² (83.4 cm²). Aluminum angle side supports rise from the corners and slope inward to support a 10 in² (25.4 cm²) top frame constructed of the same materials as the base. Fiberglas℠ screening is fastened to the aluminum supports with silicon caulk and to the wood with staples. The trap can be made completely buoyant by attaching styrofoam blocks to the corners of the base.

The plastic top is 10 in² (25.4 cm²) × 3/16 in (0.5 cm) and has 2 pieces of aluminum angle attached with pop rivets to secure it in the opening of the trap. Clear Con-Tact[3] brand self

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[3] Con-Tact is a registered trademark of Rubbermaid, sold by Carlan, Inc., Stamford, CT 06906.

adhesive shelf liner is applied between the aluminum angles and painted with Tack Trap[4], a non-drying adhesive. Clean up may be performed by peeling off the Con-Tact™, thus preventing undue mess or deterioration of the plastic top from exposure to solvents.

The relative efficiency of the sticky trap was compared to a baffle trap in laboratory and field studies. In the laboratory, 7 traps of each design were placed over 8 in (20.3 cm) × 12 in (30.5 cm) aluminum pans containing 100 4th instar *Culex quinquefasciatus* Say larvae. After emergence was completed, the number of adult mosquitoes collected in both trap types was tabulated.

In the field, a trap of each design was placed on a dense floating mat of water hyacinth, *Eichhornia crassipes* (Mart.) Solms. Water hyacinth serves as a host for the attachment of larval *Mansonia* sp. mosquitoes (Bidlingmayer 1968) and provided a site for comparing the traps under natural conditions. The traps were placed equidistant from the shoreline and were moved several feet every 4 weeks to prevent overtrapping of a given location. Collections were made biweekly for 34 weeks from early May through December, 1982. Data from both the laboratory and the field were subjected to a *t*-test (Zar 1974) to determine if the traps were significantly different in collection efficiency.

RESULTS AND DISCUSSION

Cost and ease of construction are two major advantages of the sticky trap. The materials for a sticky trap were about $15.00, while the baffle design was around $30.00. The cost differential was due primarily to the expense of the collection cone, polyethelene collection bottles and preservative fluid used in the baffle trap. Fabricating and assembling the baffle was much more difficult than cutting a piece of square plastic for the sticky trap.

The most important difference between the traps was collection efficiency. The results in the laboratory study (Table 1) indicate that the sticky trap mean was more than 2.5 times that of the baffle trap, a highly significant difference according to the *t*-test. The number of adults emerging under both traps was nearly identical, but the mosquitoes apparently could not negotiate the baffle easily. A sample from one baffle trap was accidentally discarded prior to processing, so that 6 traps of this design were available as opposed to 7 sticky traps.

Table 1. The number of adult *Culex quinquefasciatus* collected in baffle vs. sticky traps.

	Baffle trap (n = 6)	Sticky trap (n = 7)
Mean ± S.E.*	9.7 ± 4.1	24.4 ± 3.8
Total	58.0	171.0

* Means significantly different in t-test at $p < 0.01$.

Data from the field comparison support the laboratory findings (Table 2). Mosquitoes from the genus *Mansonia* were most abundant and were also the main group of interest in the study, so they are given special attention. The figures presented are the total of all male and female *Ma. titillans* and *Ma. dyari* combined. Females of these 2 mosquitoes are easily identified, however, the males are more difficult to distinguish. Generally, over 95% of the females from both traps were *Ma. titillans*. The sticky trap captured approximately 2.5 times the number of *Mansonia* sp. as the baffle trap. Once again, the means were significantly different, indicating that the sticky trap was more successful at collecting adult mosquitoes.

Other species of mosquitoes collected at the field site included *Cq. perturbans, Culex nigripalpus* Theobald, *Cx. salinarius* Coq., *Anopheles crucians* Wied. and *Uranotaenia* sp. These mosquitoes were added to the *Mansonia* sp. totals for each trap, and the means were again significantly different (Table 2). In fact, the sticky trap collected an average of more than 3 times as many mosquitoes in the field as the baffle trap.

CONCLUSIONS

The emergence trap presented here is a synthesis of features from previous designs. The pyramidal base is essentially the same as that described by Aubin et al. (1973) while the clear plastic top coated with an adhesive is similar to the trap of Mason and Sublette (1971). The latter authors indicated that spurious collections of wind-blown organisms were a problem, but enclosing the trap caused a condensation build up that damaged the specimens. This did not take place with the large screened base of the current design.

The modified emergence trap collected 2.5–3.0 times the number of mosquitoes as the baffle trap and was approximately half the cost. The sticky design should provide more accurate estimates of adult mosquito production while the reduced expense enables researchers to sample more sites. Although the trap was tested for collecting mosquitoes, other workers have used emergence traps to study a variety of aquatic insects (Mason and Sublette 1971, Les-

[4] Tack Trap is a registered trademark of Animal Repellents, Inc., P.O. Box 999, Griffin, GA 30224.

Table 2. The number of mosquitoes collected in biweekly field samples in a baffle vs. a sticky trap (n = 17).

	Mansonia sp.		Total mosquitoes	
	Baffle	Sticky	Baffle	Sticky
Mean ± S.E.*	6.12 ± 1.81	15.12 ± 2.55	7.47 ± 2.01	24.94 ± 4.02
Total	104.00	257.00	127.00	424.00

* Means significantly different in t-test at $p < 0.01$ for *Mansonia* spp. and $p < 0.001$ for total mosquitoes.

age and Harrison 1979). As a result, the sticky trap design should not necessarily be limited to sampling mosquito populations.

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References Cited

Allan, S. A., G. A. Surgeoner, B. V. Helson and D. H. Pengelly. 1981. Seasonal activity of *Mansonia perturbans* adults (Diptera: Culicidae) in southwestern Ontario. Can. Entomol. 113:133–139.

Armstrong, R. L. 1941. *Mansonia perturbans* (Walk.) on Cape Cod. Proc. NJ Mosq. Exterm. Assoc. 28:184–188.

Aubin, A., J. P. Bourassa and M. Pellisier. 1973. An effective trap for the capture of mosquitoes. Mosq. News 33:251–252.

Bidlingmayer, W. L. 1954. Description of a trap for *Mansonia* larvae. Mosq. News 14:55–58.

Bidlingmayer, W. L. 1968. Larval development of *Mansonia* mosquitoes in central Florida. Mosq. News 28:51–57.

Lesage, L. and A. D. Harrison, 1979. Improved traps and techniques for the study of emerging aquatic insects. Entomol. News 90:65–78.

Lewis, D. J. and G. F. Bennett. 1980. Observations on the biology of *Mansonia perturbans* (Walker) (Diptera: Culicidae) in the Nova Scotia-New Brunswick border region. Can. J. Zool. 58:2084–2088.

Lounibos, L. P. and R. L. Escher. 1983. Seasonality and sampling of *Coquillettidia perturbans* (Diptera: Culicidae) in South Florida. Environ. Entomol. 12:1087–1093.

Mason, W. T., Jr. and J. E. Sublette. 1971. Collecting Ohio River Basin Chironomidae (Diptera) with a floating sticky trap. Can. Entomol. 103:397–404.

Service, M. W. 1976. Mosquito ecology: Field sampling methods. Halsted Press, New York.

Zar, J. H. 1974. Biostatistical analysis. Prentice-Hall, Inc. Englewood Cliffs, NJ.