tainers as breeding sites. Populations of *Ae. atropalpus* prefer rockpools almost exclusively and are entirely autogenous for the first gonotrophic cycle, after which they may take a blood meal.

The following are the records of adult and larval collections for Ohio and Indiana. Adults were collected in light traps or mechanical aspirators during bite and shelter collections.

Summit County, Barberton, Ohio: The first collection was of 8 adult females on July 13, 1972. Twenty-nine more females were collected in 1972, 94 in 1975, 88 in 1976, 19 in 1977, and 3 in 1979.

Huron County, Norwalk and Willard, Ohio: Two adult females were collected on July 6, 1977, in Norwalk, and 1 female on August 29, 1977, in Willard.

Darke County, Greenville, Ohio: One adult female and 1 fourth-instar larva were collected on July 9, 1979, at a tire distribution and repair company. Ninety-one adults and several hundred larvae were collected during 4 visits (July 9, August 13, September 17 and 18, and October 2, 1979). Cohabiting the tires with *Ae. atropalpus* were *Ae. triseriatus* (Say), *Anopheles barberi* Coquillett, *An. punctipennis* (Say), *Culex pipiens* (Linneaus), *Cx. restuans* Theobald, *Cx. salinarius* Coquillett, *Cx. territans* Walker, *Orthopodomyia alba* (Baker) and *Or. signifera* (Coquillett).

St. Joseph County, South Bend, Indiana: Fourteen larvae were collected on July 17, 1979, from discarded tires in an auto salvage yard. Return visits on August 9 and August 20, 1979 yielded 2 and 7 *Ae. atropalpus* larvae, respectively. Cohabiting these tires were *Ae. triseriatus* and *Cx. pipiens.* At a second site approximately 0.5 km from the first, 6 larvae of *Ae. atropalpus* were taken from discarded tires, along with a number of *Ae. triseriatus, Cx. restuans,* and *Cx. territans.*

Voucher specimens of both adults and larvae discussed in this report have been deposited in both the VBDU reference collection and in the UND collection.

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References Cited

Covell, C. J., Jr., and A. J. Brownell. 1979. *Aedes atropalpus* in abandoned tires in Jefferson County, Kentucky. Mosq. News 39:142.

Munstermann, L. E. 1980. Separation of components of the *Aedes atropalpus* group (Diptera: Culicidae) by analysis of enzyme variation. Ann. Ent. Soc. Amer. in press.

Siverly, R. E. 1972. Mosquitoes of Indiana. Indiana State Board of Health, Indianapolis. 126 pp.

Zavortink, T. J. 1972. Mosquito studies (Diptera: Culicidae). XXVIII. The New World species formerly placed in *Aedes (Finlaya),* Contribs. Amer. Entomol. Inst. 8(3):206 pp.

AN ADULT EMERGENCE TRAP FOR USE IN SMALL SHALLOW PONDS

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A large variety of traps for emerging adult mosquitoes has been devised (Service 1976). The standard type for obtaining quantitative estimates of population size or density has been some sort of conical or box trap, either floating (Mundie 1956) or attached to the substrate (Corbet 1965), and from which mosquitoes are removed by a collecting jar on top, or by aspiration, or both. However, our experience with this type of trap has been that, no matter what material the trap is made from (metal, cloth, nylon screen), mosquitoes tend to remain in the cone and do not enter the collecting jar. Furthermore, aspiration of mosquitoes out of the trap is too time-consuming when one is dealing with the number of traps required to adequately sample even a small pond for population estimates. Therefore we have developed a modification of the standard cone trap, in which the cone is the collecting part of the trap and is removed entirely and replaced on each sampling occasion.

The frame for the trap (Fig. 1) consists of a circular, aluminum alloy rim, 25 cm in diameter, the position of which can be adjusted on a 1 m long stainless steel spike. The conical nylon net bag has an elastic base which fits tightly over the rim. The spike is pushed into the

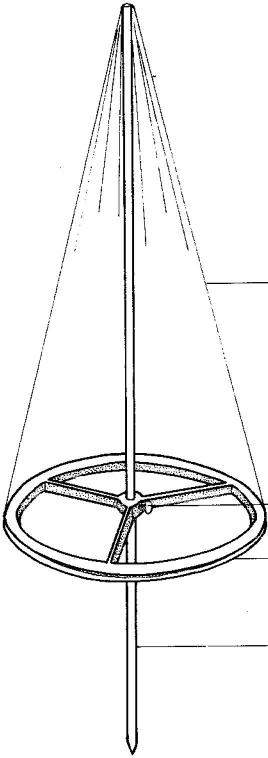

Fig. 1. The adult emergence trap.

substrate and the rim adjusted so that it is below the water surface.

To empty the trap, the net bag is slipped off the rim while still under the water, and the base of the bag is tightly gripped around the central spike. In this position, the bag is slipped off the spike and the opening is tied off. A new bag is then placed on the frame.

The mosquitoes are killed by placing the bags in the freezer on return to the laboratory. If work is being done in remote areas, the bags may be enclosed in a glass vessel containing a chemical killing agent.

A trap such as this is usually placed so that the base of the cone is just below the water surface. However, mosquito pupae may be attracted to or may avoid such traps on the basis of differences in light intensity, temperature or surface disturbance between the traps and the open water. It is very difficult to test whether attraction or avoidance is taking place, but we have performed 2 tests of this trap which suggest that the trap is unbiased. The tests were carried out in small (100—200 m^2), shallow (<30 cm) ponds in aspen parkland habitat in southern Alberta.

The 1st test involved making estimates of numbers of 4th stage larvae and pupae of *Aedes cataphylla* Dyar by methods described by Enfield and Pritchard (1977), and then estimating the size of the emerging adult population. The adult emergence traps were deployed in 2 ways; they were either adjusted so that the base was just below the water surface (10 traps), or they were pushed all the way down to the substrate (10 traps), thereby supposedly trapping pupae in the water column. Four traps were situated randomly along each of 5 radii and they were emptied and re-sited every day over a 14-day period. The results are shown in Table 1.

Emergence cages in both situations gave estimates of the correct order of magnitude relative to the estimates for 4th stage larvae and pupae. However, more than twice as many adults emerged into the surface traps as did into the deep traps. Either pupae were attracted to the surface traps or they escaped from the deep traps. The latter appears more likely because the traps cannot be pushed to

Table 1. Estimated size of a population of *Aedes cataphylla* in a small pond.

Date	Stages Present	Population Size ± Std. Error
3 May 1979	Larvae IV and Pupae	257,366 ± 27,176
10 May 1979	Larvae IV and Pupae	153,928 ± 20,113
14 May 1979 to 28 May 1979	Emerging Adults	[a]29,076 ± 5,745 [b]70,212 ± 14,055

[a] Emergence cages on pond substrate.
[b] Emergence cages at water surface.

the bottom very rapidly and pupae almost certainly swim away as the trap is being lowered. Also, because of the uneven nature of the substrate, large gaps are left around the bottom of the trap. Morgan *et al.* (1963), in their comparison of emergence traps, explain the poor performance of certain surface traps by suggesting that aquatic insect pupae are generally highly phototactic prior to adult emergence and are more likely to avoid traps than concentrate under them. Therefore we believe that the higher capture for the traps at the surface is the more realistic.

This is supported by the 2nd test made of the traps, which was designed to identify any effect of shade provided by the traps on mosquito emergence. Nine traps were laid out in a 3 × 3 Latin Square design prior to emergence in a population of *Culiseta inornata* (Williston). The traps were covered by 1, 2, or 3 net bags to give different amounts of shade, and they were emptied every day between September 14 and 30, 1979. Light readings inside and outside the cages were taken each time the traps were emptied. The results (Table 2) show that shade provided by the traps had no influence on the number of mosquitoes that emerged into them. Furthermore, extrapolation to the open water situation suggests that mosquitoes will not be attracted to the shade provided by the traps, because light readings in open water fall next within the sequence of those under the emergence traps.

Table 2. The numbers of emerging *Culiseta inornata* adults trapped in emergence cages with different shade values.

No. net covers	Mean relative light reading (ohms)	Number of mosquitoes trapped*			
		Trap 1	Trap 2	Trap 3	Total
3	3.73	37	41	31	109
2	3.33	42	39	37	118
1	2.83	21	34	49	104
0	2.43				

* 3 × 3 Latin square design: $F_{2,2} < 1$.

We conclude, therefore, that this design provides a simple, accurate and convenient trap for quantitative estimates of emerging adult mosquitoes from small, shallow ponds.

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References Cited

Corbet, P. S. 1965. An insect emergence trap for quantitative studies in shallow ponds. Can. Ent. 97: 845–848.

Enfield, M. A. and G. Pritchard. 1977. Methods for sampling immature stages of *Aedes* spp. (Diptera: Culicidae) in temporary ponds. Can. Ent. 109: 1435–1444.

Morgan, N. C., A. B. Waddell and W. B. Hall. 1963. A comparison of catches of emerging aquatic insects in floating box and submerged funnel traps. J. Anim. Ecol. 32: 203–219.

Mundie, J. H. 1956. Emergence traps for aquatic insects. Mitt. Int. Verein. Theor. Angew. Limnol. 7: 1–13.

Service, M. W. 1976. Mosquito Ecology. Field Sampling Methods. John Wiley and Sons, Inc. New York.

THE OCCURRENCE OF *AEDES TRIVITTATUS* IN ALABAMA[1]

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Aedes (Ochlerotatus) trivittatus (Coquillert) has been reported from 38 states and the District of Columbia in the continental United States (Carpenter and La Casse 1955, Carpenter 1968, 1970). King et al. (1966) noted that *Ae. trivittatus* had been recorded in all the southeastern states except Florida, Alabama, and Mississippi. The general range of this mosquito extends through all the northern states and southern Canada to the Rocky Mountains.

Abdel-Malek (1948) stated that in Ohio this species breeds in temporary pools in open sites and in shallow ditches covered with vegetation. Carpenter and La Casse (1955) noted that larvae of this species may be found any time during the summer following rains, in flood water pools, in meadows, swamps, and woodlands throughout its range.

Additional notes on the bionomics of this species have been presented by Horsfall et al. 1958; Breeland et al. 1961; Wright and Knight 1966; Pinger and Rowley 1972 and 1975; and Arnell, 1976.

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