EVALUATION OF SOME OVITRAP MATERIALS USED FOR *AEDES AEGYPTI* SURVEILLANCE

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ABSTRACT. Two types of ovitrap jars and two types of paddles were monitored to determine causes of data losses during *Aedes aegypti* surveillance. In addition, different ovitrap units were compared in field trials to determine their attractiveness to *Ae. aegypti* oviposition. Black plastic or black glass jars were equally attractive to oviposition whether equipped with fiberboard or velour paper paddles. Fiberboard paddles were more functional because velour paddles were being destroyed by snails and cockroaches. While glass jars often flooded, plastic jars were easily tipped over by animals. Plastic jars were considered more functional because the material permits modifications such as a drainage hole to prevent flooding, a mouth bar to prevent animals from drinking and easy attachment of stabilization devices.

INTRODUCTION

Fay and Perry (1965) were first to use ovitraps for *Aedes aegypti* (Linn.) surveillance, and Fay and Eliason (1966) demonstrated the ovitrap was in some aspects superior to larval surveys. Ovitraps were also shown to be useful sampling devices in determining *Ae. aegypti* distribution (Hoffman and Killingworth 1967), seasonal population fluctuation (Jakob and Bevier 1969) and in evaluating the efficacy of aerial ULV malathion application (Kilpatrick et al. 1970).

Based upon choice experiments, Thaggard and Eliason (1969) and Jakob et al. (1970), respectively, determined that a black, ceramic glass jar and a velour paper paddle were the best equipment for ovitrap use. Since 1974, New Orleans Mosquito Control has used the black, ceramic glass jar equipped with either a velour paper or fiberboard (CDC 1979) paddle for seasonal surveillance of *Ae. aegypti*. The difficulty of obtaining the standard ceramic glass jar from suppliers and a significant loss of data due to flooding and tipping of ovitraps as well as velour paddle destruction prompted an evaluation of alternative materials for ovitrap use. Thus studies compared data losses using plastic or glass ovitraps equipped with either fiberboard or velour paper paddles. Field trials were also conducted to determine the comparative attractiveness of these ovitrap materials to *Ae. aegypti* oviposition.

MATERIALS AND METHODS

Two ovitrap units were compared as to conditions related to the loss of trapping information. One unit consisted of a glossy black, glass jar (0.5 liter volume, 7.5 cm inside diameter (id) top and bottom, 12.5 cm high, 256 g wt) incorporating an interior, untempered fiberboard (Valtex®, standard blond) paddle (12.5 × 2.0 × 0.4 cm). The second unit consisted of a glossy black, polypropylene plastic jar (0.5 liter volume, 8.5 cm id top, 6.0 cm id bottom, 11 cm high, 27 g wt) equipped with a red velour paper paddle (12.5 × 2.0 × 0.1 cm). A drain hole was positioned 5 cm up from the base of each plastic jar.

Forty oviposition sites were selected throughout urban New Orleans, and two different units were placed 15 cm apart at each location. Paddles were vertically affixed with large paper clips inside jars, rough surface exposed, and the jars were filled to a depth of 5 cm with tap water. At the end of each trial week, trap conditions were recorded in the field as tipped, dried, missing, flooded or broken. Traps were cleaned and rotated between original positions each week. Paddles, which were replaced weekly, were examined in the laboratory for damage and the presence of animal hair. The study lasted for 18 weeks (June to mid-September, 1982) so that each type of ovitrap unit had 720 comparative trials.

To compare trap attractiveness, all combinations of ovitrap jar and paddle types described above were compared in the field for *Ae. aegypti* oviposition. Materials used are coded glass jar (G), plastic jar (P), fiberboard paddle (F) and velour paper paddle (V). Comparative field tests including appropriate controls were as follows:

Container comparison 1: Test—G vs P both w/ V

Controls—G vs G both w/ V and P vs P both w/ V

Container comparison 11: Test—G vs P both w/ F

Controls—G vs G both w/ F and P vs P both w/ F

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Paddle comparison I: Test—V vs F both w/ G
Controls—V vs V both w/ G and F vs F both w/ G

Paddle comparison II: Test—V vs F both w/ P
Controls—V vs V both w/ P and F vs F both w/ P

The control groups for container comparisons also served as controls for the paddle comparison trials.

For each test or control comparison 10 oviposition sites were selected and egg collection occurred for 6 wk (mid-August to September, 1982). A loss of data from any trapping trial on a site due to flooding, drying or tipping of either ovitrap resulted in eliminating all trials conducted at such a site. This permitted consistent pairing of data over time from sites at which there was no interference with oviposition. A minimum of 5 sites remained available for comparison at the end of the 6 weeks for each test or control group. Paddles were collected weekly, and *Ae. aegypti* eggs were counted using a stereo-microscope at 40×. The egg counts were paired by site and time, and the results of at least 30 trials for each test or control comparison were analyzed by the paired *t*-test.

RESULTS

The study of conditions related to the loss of trapping information showed that after 720 trials data were lost from 52 (7.2%) and 78 (10.8%) of the glass and plastic ovitraps, respectively. Tipping accounted for the majority of plastic container data losses at 6.8% while only 3.1% of glass containers were tipped. Data losses attributed to dried or missing containers was minimal for glass containers (0.7%) but significantly greater for plastic containers (3.8%). Flooding accounted for the principal data loss for glass containers at 3.2%. Animal hair was found on tipped or dried plastic and glass container paddles in 43 of 61 and 11 of 23 instances, respectively. Animal hair was not found on paddles from containers that were undisturbed and/or filled with water. Broken containers, a clear indication of human interference, accounted for only 0.2% of data losses for both glass and plastic ovitraps.

Velour paper paddles were being extensively damaged at the onset of the study. A land snail, *Mesodon thyroides* (Say) was identified as the destructive agent. About 13% of 720 velour paddles were destroyed by snails and 1.4% were destroyed by roaches. While snails destroyed the complete velour paddle by ingesting it, roach damage was distinguished by the loss of the surface piling which was eaten off the paper.

The results of the comparisons of various ovitrap units for attracting *Ae. aegypti* oviposition are shown in Table 1. No combination of glass or plastic container with velour or fiberboard paddle was significantly more attractive than any other. All paired *t*-test values had P > 0.30 indicating no difference between pairs.

Table 1. Comparison of attractiveness of various combinations of ovitrap containers and paddles by paired *t*-test on numbers of *Aedes aegypti* eggs oviposited during at least 30 paired one week trials.

	Containers compared (mean number eggs)	Paddle used	No. paired trials	*T*-test probability[e]
Test I	G[a] (45.5) vs P[b] (41.1)	V[c]	36	0.5259
Control IA	G (23.6) vs G (24.3)	V	30	0.8926
Control IB	P (27.2) vs P (23.1)	V	30	0.3578
Test II	G (69.2) vs P (71.3)	F[d]	36	0.5875
Control IIA	G (41.4) vs G (44.8)	F	30	0.6388
Control IIB	P (25.5) vs P (26.4)	F	30	0.8679
	Paddles compared (Mean number eggs)	**Container used**	**No. paired trials**	***T*-test probability**
Test III	V (71.3) vs F (82.6)	G	36	0.3261
Control IIIA	V (23.6) vs V (24.3)	G	30	0.8926
Control IIIB	F (41.4) vs F (44.8)	G	30	0.6388
Test IV	V (50.8) vs F (53.8)	P	36	0.6256
Control IVA	V (27.2) vs V (23.1)	P	30	0.3578
Control IVB	F (25.5) vs F (26.4)	P	30	0.8679

[a] Glossy black glass jar.
[b] Glossy black polypropylene plastic jar.
[c] Velour paper paddle.
[d] Fiberboard paddle.
[e] P>0.10 indicates no significant difference.

DISCUSSION AND CONCLUSIONS

Data losses from glass containers occurred primarily because of flooding, whereas plastic containers did not flood because of drainage holes. A complicated ovitrap with a drain was developed by Yates (1974) to study egg deposition relative to water level but the design of this trap makes it cumbersome for field use. However, a drained ovitrap has additional advantages other than preventing obstruction due to paddle submergence by flooding. A drained ovitrap cannot be overfilled upon routine maintenance and it is less likely that eggs laid above the drainage line will hatch before paddles are replaced. Premature hatching was observed in studies of routine ovitrap surveillance in Colliers, Florida, where *Ae. aegypti* life-cycle completion occurred in drained ovitraps (S. A. Richie, personal communication). These observations suggest that hatching occurred when the eggs above the drainline were directly soaked by rain but not flooded by rising water (Frank and Lynn 1982). Flooding or rain soaking may be prevented by sheltering traps where possible.

Data losses from plastic containers occurred primarily because they tipped and secondarily because they were missing or dried. Given the number of tipped and dried containers with paddles coated with animal hair, it was obvious that rats, cats or dogs drinking from plastic or glass containers were the cause of these types of ovitrap data losses. Barring animal access to water by a simple brass rod across the diameter of the container mouth and anchoring or stablizing plastic jars seem practical solutions to these problems.

Causes of data losses due to damaged paddles were clearly evident for the velour paddles. Snail and roach damage was so frequent, the use of velour paddles in New Orleans is not practical. Other factors considered by Jakob et al. (1970) to make velour paddles more desirable for use, such as slightly easier egg-count readability and low weight for cheaper mail transport, are minor considerations in view of the data losses that occur due to destruction. The fiberboard paddle, in contrast, was indestructible. However, it is possible that snails and roaches ate or dislodged some eggs on fiberboard paddles since both of these invertebrates were observed on such paddles. There is no apparent operational solution to this problem. Frank and Lynn (1982) suggest that ovitrap data losses due to egg predation may be reduced by establishing a short surveillance interval of 2 days. Although paddles exposed to a 7 day interval may experience more predation, relative information will be produced as long as the sampling intervals are the same. An overriding consideration is that *Ae. aegypti* ovitrap surveillance on a weekly interval is operationally feasible, whereas a shorter interval is costly and twice as labor intensive.

Choice experiments in this study showed no significant difference in the use of glass versus plastic containers in attracting *Ae. aegypti* oviposition, agreeing with the findings of Thaggard and Eliason (1969). Our study also confirmed the findings of Jakob et al. (1970) that fiberboard or velour paddles were equally attractive for *Ae. aegypti* oviposition. Although pairing showed no differences in attractiveness to oviposition of the various combinations of paddles and containers, different average numbers of eggs were observed between test and control groups. This result was expected and unavoidable since ovitrap surveillance for different test or control groups occurred in a variety of city sectors, all with slightly different degrees of *Ae. aegypti* infestation. We believe that the use of sectors with different degrees of infestation did not influence *Ae. aegypti* in making an oviposition choice between ovitrap units from one sector to another.

In conclusion, our study shows that the ovitrap materials tested were equally attractive regardless of the paddle or container used. Furthermore, the choice of an ovitrap unit is best determined by operational effectiveness based upon design to prevent data losses due to tipping, flooding and animal interference or destruction. Both plastic containers and fiberboard paddles are readily available from suppliers and may be used by mosquito control districts where glass containers and velour paddles function poorly or cannot be obtained.

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References Cited

Center for Disease Control, Bureau of Tropical Diseases. 1979. Vector Topics No. 4: Biology and control of *Aedes aegypti*. CDC, PHS, DHEW, Atlanta, Ga., 68 pp.

Fay, R. W. and A. S. Perry. 1965. Laboratory studies of ovipositional preferences of *Aedes aegypti*. Mosq. News 25:276–281.

Fay, R. W. and D. A. Eliason. 1966. A preferred oviposition site as a surveillance method for *Aedes aegypti*. Mosq. News 26:531–535.

Frank, J. H. and H. C. Lynn. 1982. Standardizing oviposition traps for *Aedes aegypti* and *Culex quinquefasciatus:* Time and medium. J. Fla. Anti-Mosq. Assoc. 53:22–27.

Hoffmann, B. L. and B. F. Killingsworth. 1967. The egg-laying habits of *Aedes aegypti* (Linnaeus) in central Texas. Mosq. News 27:466–469.

Jakob, W. L. and G. A. Bevier. 1969. Application of ovitraps in the U.S. *Aedes aegypti* eradication program. Mosq. News 29:55–62.

Jakob, W. L., R. W. Fay, D. L. von Windeguth and H. F. Schoof. 1970. Evaluation of materials for ovitrap paddles in *Aedes aegypti* surveillance. J. Econ. Entomol. 63:1013–1014.

Kilpatrick, J. W., R. J. Tonn and S. Jatanasen. 1970. Evaluation of ULV insecticide dispensing systems for use in single-engine aircraft and their effectiveness against *Aedes aegypti* populations in Southeast Asia. Bull. W.H.O. 42:1–14.

Thaggard, C. W. and D. A. Eliason. 1969. Field evaluation of components for *Aedes aegypti* (L.) oviposition trap. Mosq. News 29:608–612.

Yates, M. 1974. An artificial oviposition site for tree-hole breeding mosquitoes. Entomol. Gaz. 25:251–254.