APPLICATION OF OVITRAPS IN THE U. S. AEDES AEGYPTI ERADICATION PROGRAM

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INTRODUCTION. A reliable, rapid, and economical surveillance method is an integral part of any control or eradication program. *Aedes aegypti* eradication programs have heretofore relied primarily on larval surveys to determine the extent of infestation and the effectiveness of control measures. In the United States, such surveys have generally been made on a comprehensive basis at 2- or 3-month intervals.

Following laboratory studies on the ovipositional preferences of *Ae. aegypti* (Fay and Perry, 1965), preliminary field trials of the ovitrap showed that the oviposition technique offered a sensitive method for determining the presence of adult *Ae. aegypti* females (Fay and Eliason, 1966). Further developmental studies at the Florida Field Research Activities, Aedes aegypti Eradication Program (unpublished data) indicated that an equilateral distribution of ovitraps at grids of 350, 500, and 700 feet warranted further investigation as a means of detecting distribution and, to some extent, the degree of *aegypti* infestations.

The ovitrap consists of a pint glass jar with straight, slightly tapered sides. The opening measures almost 3 inches in diameter while the jar is approximately 5 inches in height. The jar is coated on the outside only with a glossy black ceramic paint. Water is placed in the jar to serve as a source of moisture for the wicking oviposition substrate (paddle). The paddles used in this work were made of a particular type of ⅛″ hardboard with one side screenback and measured ¾″ in width x 5″ in length.

In 1967 extensive developmental trials with the ovitrap were undertaken in several states of the AAE Program. Consistent with operational plans a northern and a southern location of areas in the preparatory phase were selected. Ovitrap studies were also conducted in Program areas in the attack and consolidation stages (Jakob and Bevier, in preparation). The present paper reports the results obtained in preparatory areas of Florida, Georgia, Alabama, and Texas.

METHODS. Based on the promising results obtained in Florida with ovitraps distributed on a grid basis, studies were planned for zone-wide trap placements at grids of 400, 500, 600, and 700 feet. Approximately 300 to 400 traps were operated on a weekly schedule in Orlando and Gainesville, Florida; Augusta and Waycross, Georgia; Mobile and Northport (Tuscaloosa), Alabama; and San Marcos and Palestine, Texas. The work involved generally required the efforts of one man on a full-time basis in each area. Ovitraps were generally placed in operation during the week of April 9–15 (week 15 of the year).

The following guidelines served as the basis for selection of locations for ovitraps on a premises:

A. The trap should be placed in proximity to other potential breeding containers, in a situation where it won't readily be flooded.
B. The trap should be located in partial or total shade—avoid placement in direct sunlight.
C. The trap should be located in close proximity to situations offering adult resting sites, such as shrubbery, trash piles, etc.
D. The trap should be placed at ground

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level and not on ledges or suspended from bushes.

E. As far as possible, ovitraps should be located so that disturbance by children would be at a minimum.

F. In general, ovitraps should be located at the rear or sides of premises rather than in the front yard or near the street.

Each week the inspector servicing the ovitrap placed a new paddle in the jar and adjusted the water level. Prior to placement in the jar, each paddle was marked to show its location and the week of the year during which it was exposed. A cleaning procedure was initiated shortly after the beginning of the study in which the jar was scrubbed each week with a stiff-bristled nylon brush to prevent the accumulation of salts and dirt on the inside of the jar.

Each exposed paddle was placed in a separate plastic envelope and returned to the office for microscopic examination. A dissecting microscope was employed in this examination for the presence and identification of mosquito eggs. *Aedes aegypti* eggs can be readily distinguished from those of *Aedes triseriatus*, another species which will also readily oviposit in ovitraps. Only in the areas of Texas where *Aedes atropalpus* occurs was it necessary to hatch the eggs and make differentiations by identification of larvae.

RESULTS. The percentages of ovitraps found positive by week in Orlando, Waycross, and Mobile are shown in Figures

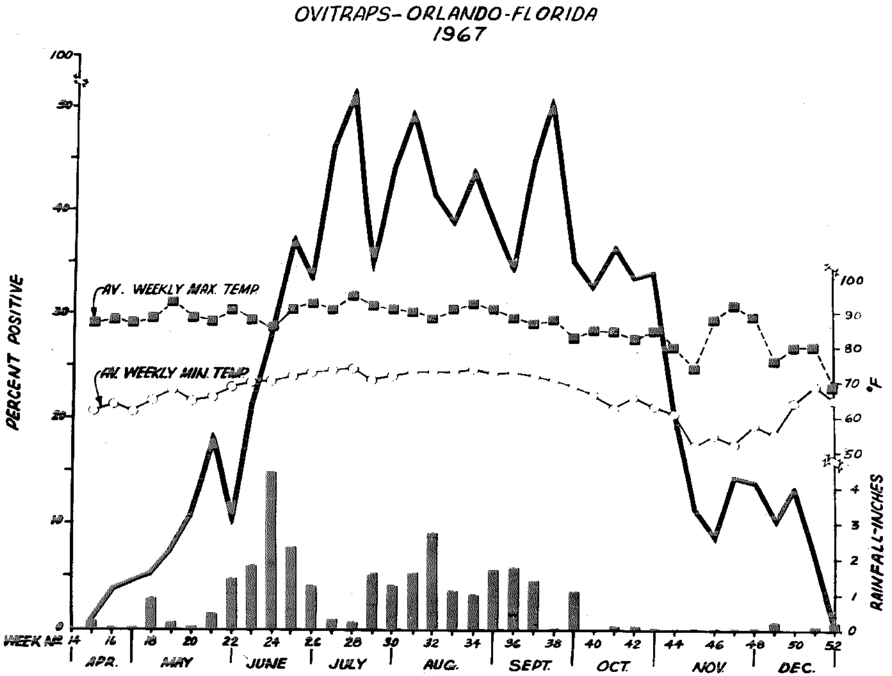

FIG. 1.—*Aedes aegypti* oviposition pattern in relation to week of the year, temperature, and rainfall in Orlando, Florida, 1967.

1, 2, and 3, respectively. Each locality shows a rather sharp buildup in oviposition activity by week 23. Each also shows a high level of ovitrap positivity during weeks 24 through 41. Oviposition activity in Waycross decreased significantly by week 42, apparently in response to decreasing temperatures. A similar drop in ovitrap positivity at week 42 (Mobile) and weeks 45 and 46 (Orlando) appears related to the low rainfall during the preceding weeks, as well as the lower temperatures prevailing at the time.

The peaks in the Orlando results at weeks 25 and 28 follow successive weeks of precipitation measuring 1¼ inches or more per week. Similar increases in oviposition activity occurred at Waycross during week 31 and at Mobile during week 38 following significant rainfall approximately 2 weeks previously. The degree of *Ae. aegypti* infestations in these areas is indicated by peaks showing that 52, 71 and 54 percent of the ovitraps were positive in Orlando, Waycross and Mobile, respectively. A further indication of the extent of *aegypti* populations and the sensitivity of the ovitrap was shown in Orlando where almost 20 percent of the traps were positive at least half of the time. In Mobile, based on results during weeks 22 to 40, more than 95 percent of the traps were positive at least once.

Ovitrap results in Northport and Augusta are given in Figure 4. Each of these locations, of similar latitude, shows peak oviposition about week 38. Oviposition activity showed sharp declines in these

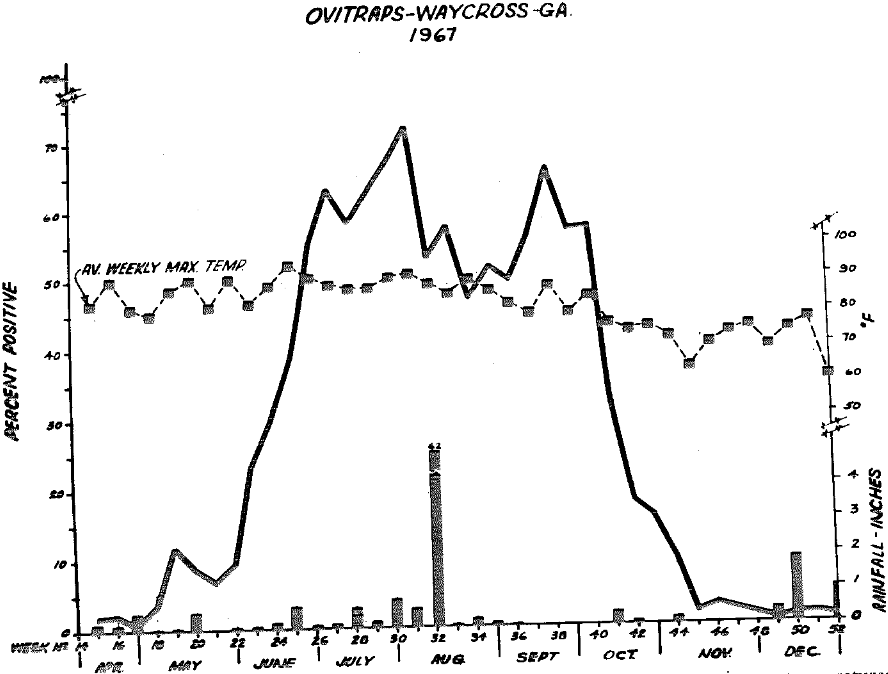

Fig. 2.—*Aedes aegypti* oviposition pattern in relation to week of the year, maximum temperatures, and rainfall, Waycross, Georgia, 1967.

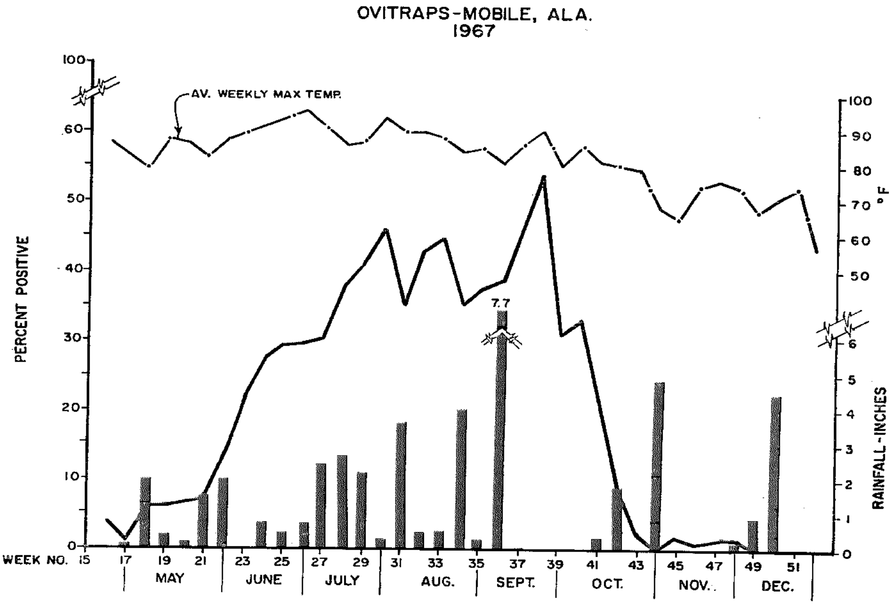

FIG. 3.—*Aedes aegypti* oviposition pattern in relation to week of the year, maximum temperatures, and rainfall, Mobile, Alabama, 1967.

areas by week 42. The somewhat slower buildup in ovitrap positives in Augusta may be attributable to the low indices resulting from eradication measures applied the previous year in the zones where ovitraps were subsequently located. The data for Northport, on the other hand, were obtained in three zones, only one of which had previously received insecticidal treatment.

The results obtained in the individual zones in Northport are given in Figure 5. Zone 3 had not received any source reduction or insecticide treatment prior to the beginning of ovitrap surveillance. Oviposition in this zone was detected at an earlier date and achieved a higher level than in the other zones. Zone 2 had received only source reduction activity in early 1967 prior to the placement of ovitraps. Zone 1 had been treated late in 1966 and received source reduction activity early in 1967. Although different grids were used in each zone, the differences in oviposition activity are considered to reflect primarily the influence of eradication efforts prior to initiation of ovitrap surveillance.

At Gainesville, Florida, which is located between two areas showing high levels of ovitrap positivity (Waycross, Georgia, and Orlando, Florida), oviposition activity failed to show increases similar to those nearby areas. The percentage of positive traps reached a peak of only 3.8 percent at week 31, and thereafter, except for 1 week, remained at 1.0 percent or less. Precipitation totalling 31 inches in the 17-week period of weeks 18 to 35 would appear adequate to effect a marked increase in the *Ae. aegypti* population. However, thermal fogging on a weekly basis by the local mosquito control organization started during week 16 and continued

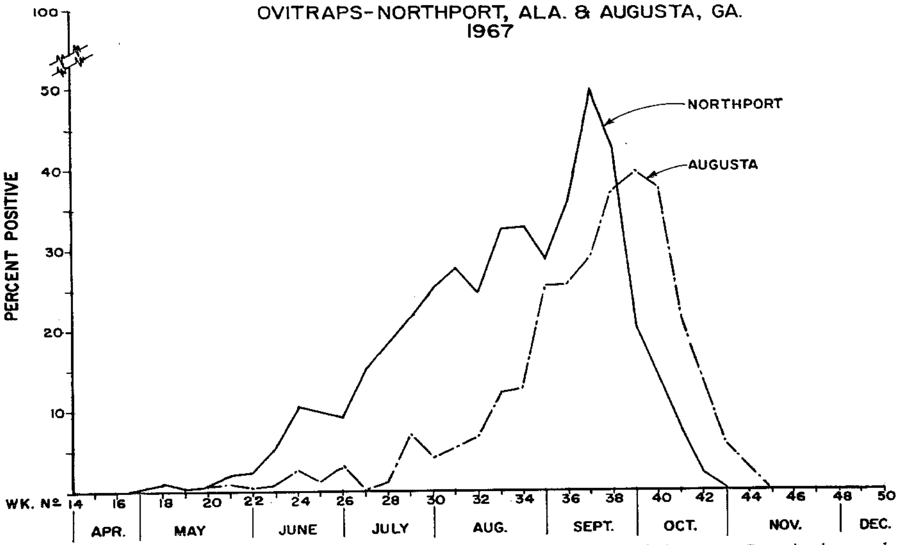

FIG. 4.—*Aedes aegypti* oviposition patterns in Northport, Alabama, and Augusta, Georgia, by week, 1967.

until week 42, and appears to have had a marked deleterious effect on the *Ae. aegypti* population.

In Palestine, Texas, where no eradication pressures had been exerted, *Ae. aegypti* oviposition shows late-season peaks at weeks 38 and 40 (Figure 6). Oviposition activity in this area follows closely the rainfall pattern as indicated by the increase in oviposition following precipitation during week 27 and the marked decrease in ovitrap positivity following 3 weeks without rainfall (weeks 30–32).

The oviposition activity in San Marcos (Figure 7) also closely follows the rainfall pattern. The prolonged dry spell early in the year (weeks 13–20 and 23–26) is reflected in the low oviposition levels prevailing through week 33. The peak (18.5 percent of the ovitraps positive) did not occur until week 40 and followed 3 successive weeks of rainfall ranging from 0.7 to 5.2 inches.

DISCUSSION. Although two or more different grids were used in each of the study areas and an attempt was made to select comparable zones, no one grid in any area showed consistently higher oviposition rates. The ovitrap results are combined by area except for the data in Figure 5, which show the differences obtained in zones having varied histories of pre-ovitrap eradication pressures. The overall results indicate the utility of ovitrap surveillance in preparatory areas.

Oviposition in 1967 reached a high level in early July in Orlando, Waycross, and Mobile. The oviposition pattern in San Marcos, a location with more severe climatological conditions than most other study areas, correlated closely with rainfall. These results agree with earlier ovitrap data obtained in nearby Austin (Hoffman and Killingsworth, 1967).

In the more northerly study areas, peak oviposition levels did not occur until mid-September to early October. Although earlier eradication efforts may have influ-

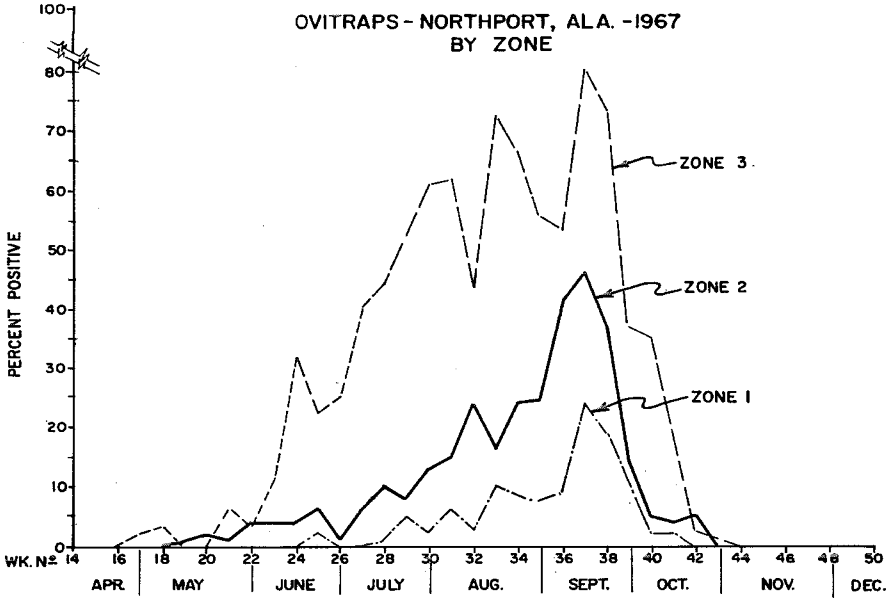

FIG. 5.—*Aedes aegypti* oviposition patterns in three zones in Northport, Alabama, 1967.

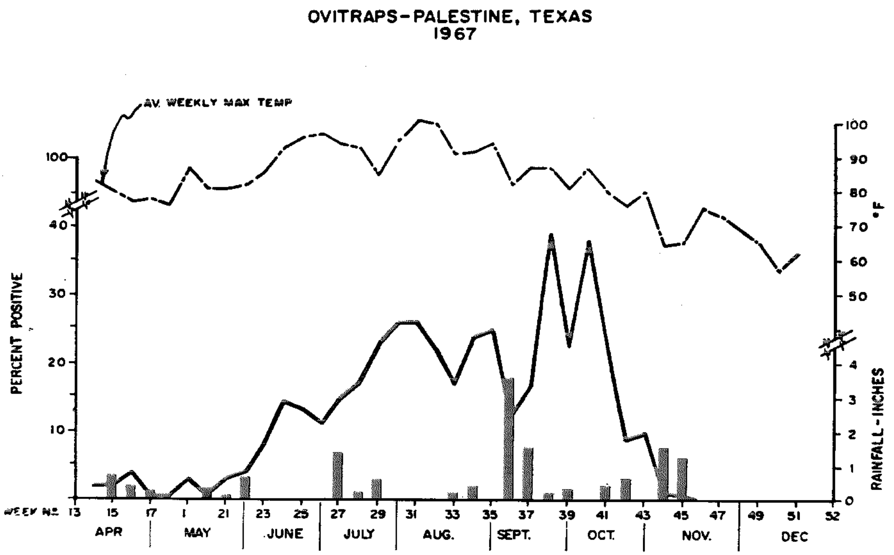

FIG. 6.—*Aedes aegypti* oviposition pattern in relation to week of the year, maximum temperatures, and rainfall, Palestine, Texas, 1967.

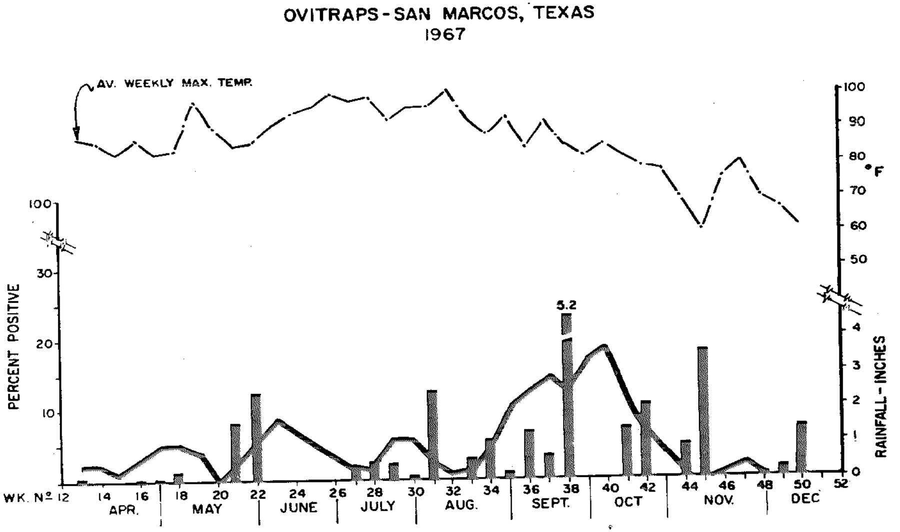

FIG. 7.—*Aedes aegypti* oviposition pattern in relation to week of the year, maximum temperatures, and rainfall, San Marcos, Texas, 1967.

enced the ovitrap results in some of these areas, the data from Palestine (untreated) and Zone 1—Northport (untreated) indicate that oviposition peaks may occur later in the season in these areas than in more southerly locations.

Ae. aegypti populations failed to increase significantly in Gainesville despite the cessation of eradication pressures by AAEP personnel. Weekly fogging for control of pest mosquitoes by the local mosquito control organization apparently also kept *aegypti* populations at a low level.

The effects of previous eradication measures in Northport, Alabama, indicated that one comprehensive treatment and source reduction activities significantly reduced *Ae. aegypti* oviposition in comparison with zones which had received only source reduction or no eradication efforts at all.

CONCLUSION. *Ae. aepypti* surveillance in preparatory areas may be reliably and economically accomplished by use of ovitraps. It would not appear necessary to maintain this surveillance for an entire season, since high levels of oviposition activity were obtained in several areas by early July. In the northerly locations studied, peak oviposition did not occur until mid-September to early October. Oviposition in the more arid area studied (San Marcos, Texas) was closely associated with periods of rainfall.

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LABORATORY EVALUATION OF TWO ORGANOPHOSPHORUS LARVICIDES AGAINST PUPAE OF *CULEX RESTUANS* THEOBALD AND INFLUENCE ON ADULT LONGEVITY

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INTRODUCTION. The availability of a compound which would kill both larvae and pupae would be of significant aid in mosquito control operations since it would make it possible to reduce the numbers of pupae as well as of larvae and adults of existing mosquito populations. None of the organophosphorus larvicides are known to kill pupae at larvicidal rates (Mulla, 1966). The characteristic quiescence of mosquito pupae affords considerable protection against larvicides in solution. This study was undertaken to determine the amount of protection and the factors influencing the degree of protection provided mosquito pupae against organophosphorus larvicides. Specific objectives were to determine the percent pupal mortality at different concentrations of Abate® (o,o,o′o′-tetramethyl o,o′-thiodi-p-phenylene phosphorothioate) and Dursban® (o,o-diethyl o–3,5,6-trichloro-2-pyridyl phosphorothioate) on mosquito pupae of different ages and to ascertain the influence on longevity of adults that emerged from pupae exposed to the larvicides.

MATERIALS AND METHODS. Laboratory tests were conducted against *Culex restuans* Theobald pupae. The pupal stage of this species lasts approximately 50 hours under laboratory conditions. Due to the large numbers of larvae needed to provide pupae for testing, plots established in the field were relied upon to furnish the test specimens. Ideal oviposition sites for *C. restuans* were produced in the field plots by adding one cup of Wayne Rabbit Ration,[3] produced by Allied Mills, Chicago, Illinois, to approximately 8 cubic feet of water every 2 weeks. Larvae were collected from the field plots and were brought to the laboratory where they were placed in white enamel trays and fed on Wayne Rabbit Ration.

The larvicides were evaluated against different age groups of pupae. The five age groups tested were (1) pupae 0–1 hour, (2) pupae 0–2 hours, (3) pupae 0–5 hours, (4) pupae 0–24 hours, and (5) pupae greater than 24 hours old. The pupae were separated into age groups by hand picking all pupae from the enamel trays at a given hour, (hour 0). All larvae that pupated from hour 0 to to hour X (hour X representing the age group desired) were picked and tested. For example, if a group 0–24 hours of age was desired, hour X was 24 hours. When a group greater than 24 hours old was desired, those pupae picked at 24 hours were held over an additional 24 hours prior to testing.

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