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FIELD TRIALS OF AN AMINE OVICIDE AGAINST *AEDES AEGYPTI* (L.)[1]

W. L. JAKOB, R. W. FAY AND D. P. WILTON

Control measures in the recent U.S. Aedes aegypti Eradication Program consisted primarily of source reduction activities and the cyclic application of residual larvicides. Despite such measures, isolated foci persisted in all areas under attack largely because the toxicants were ineffective against eggs remaining in the breeding containers. Since over much of its range in the U.S. a high percentage of the population of this species is in the egg stage during the cooler months or drought periods, application of ovicidal spray at such times should further the eradication goal.

The effectiveness of amine mixtures against *Ae. aegypti* eggs in laboratory studies has been reported (Wilton *et al.*, 1968; Cline *et al.*, 1969). The activity of amine mixtures under a number of temperature and humidity conditions and the functions of the separate components have been investigated (Wilton and Fay, 1969). Simulated field applications showed that an aqueous formulation containing ethanolamine and Duomeen L-11[2] was effective against eggs in tires and cans (Jakob, 1969). These studies led to field trials in south Florida and Mississippi during the time overwintering eggs constituted a high percentage of the existing *Ae. aegypti* population.

MATERIALS AND METHODS

SOUTH FLORIDA. Naturally occurring containers, considered likely to contain eggs, were selected as test vessels in a lower socioeconomic, residential area near Perrine, Florida, in February 1969. An attempt was made to obtain similar numbers of representative containers for comparison of the treatments with the controls. All test containers were marked with spray paint, numbered, and the location, type, approximate capacity, and actual water content recorded.

Treatment consisted of the application of aqueous formulations containing 2:0.2 percent or 4:0.4 percent of ethanolamine: Duomeen L-11. All inside surfaces of the containers were treated using a 2-gallon hand compression sprayer, operating at 40 p.s.i., and dispensing a hollow cone spray from a Teejet 5500-X18 nozzle. All liquid in the containers, including ovicide,

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[2] Manufactured by Armour Industrial Chemicals, McCook, Illinois. Use of trade names is for identification purposes only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health, Education, and Welfare.

was removed 24 or 48 hours after treatment. The containers were removed from the field, assembled under a roof, and then flooded to capacity with a hatching medium consisting of a suspension of laboratory chow in water. Larval counts in each container were made 7 to 9 days after flooding.

Temperatures during the treatment and flooding periods ranged from 46° to 82° F. and 49° to 81° F., respectively.

A total of 673 containers were recorded as test vessels but not all were recovered. In addition, those which dried out during the flooded period due to leakage or evaporation were not counted in the results. The data given are based on 230 control and 321 treated containers. Of the treated containers, 231 were metal. The 2:0.2 percent mixture was applied to 136 of these and the 4:0.4 percent formulation to the remaining 95. Only 10 of the 37 plastic containers were treated with the higher concentration of ovicide. All other test containers were treated with the 2:0.2 percent amine mixture.

MISSISSIPPI. The semi-rural community of Chunky, Mississippi, containing approximately 100 premises, was selected as a test site since the entire community could be treated by the available manpower in a relatively short time and possible reinfestation from nearby untreated foci was minimal. All potential breeding sites, including a dump site and an abundance of discarded appliances, car bodies, tar or paint buckets, etc., but excepting treeholes, were treated during week 15 of 1969 (April 8–14). Two-gallon hand compression sprayers, equipped and operated as described above for the south Florida study, were used to apply an aqueous mixture containing ethanolamine: Duomeen L-11 (4:0.4 percent). Approximately 90 gallons of spray were dispensed in the project. Animal watering devices were not treated but all were scrubbed with a nylon bristled brush to dislodge the eggs, drained, flushed with water, and refilled.

Ambient temperatures during the treatment period ranged from 57° to 80° F.

Evaluation of the treatment was based on the amount of positivity obtained from the 50 ovitraps located in the treated area. Equal numbers of ovitraps were operated in untreated areas of another semi-rural community (Hickory, Mississippi) 6 miles west of Chunky and in urban areas of Meridian, Mississippi, 15 miles east of Chunky. Ovitrap surveillance was initiated just prior to the application of ovicide and continued, with weekly servicing intervals, for 11 weeks.

RESULTS AND DISCUSSION

The numbers of treated and untreated containers producing *Ae. aegypti* larvae in south Florida are shown in Table 1. Sixty-two of the 230 control containers were positive compared with only two of the 321 treated containers (both sprayed with the lower concentration of ovicide).

TABLE 1.—Number of containers producing *Ae. aegypti* larvae in South Florida, 1969.

Container Type	Treated with Ovicide		Untreated Controls		
	Number	With Larvae	Number	With Larvae	% Positive
Metal	231	2[1]	147	41	28
Plastic	37	0	22	3	14
Glass	12	0	16	2	13
Tires	26	0	33	16	49
Misc.	15	0	12	0	0
	321	2	230	62	27

[1] Containers of $>\frac{1}{2}$ gallon capacity.

In the control group, tires were the container type which most frequently yielded larvae but the more numerous metal containers accounted for more than half of the total positives. Although the average number of larvae per positive container was similar in the two categories, 1,832 larvae were obtained from the untreated containers in contrast to only 51 from the treated ones. Such a difference indicates that dramatic reductions of the *Ae. aegypti* infestation are possible by treatment of potential breeding sites during the overwintering period (and presumably also during dry periods) when most of the population is in the egg stage. These results also suggest the treatment of tires in international commerce with an amine ovicide to prevent introduction of *Ae. aegypti* into uninfested areas.

The Mississippi field trial followed the encouraging results recorded in the Florida study. *Ae. aegypti* oviposition was first detected during week 18 in the Hickory control area. Initial ovitrap positivity in the treated (Chunky) and Meridian control areas was found during week 19. The data (Table 2) for weeks 18 through 22 clearly indicate the lag in population buildup in the treated versus the control areas with respect to both positive ovitraps and numbers of eggs. The numbers of positive ovitraps and of eggs obtained in urban Meridian during the study were higher than the counts obtained in the semi-rural untreated community of Hickory. Although the relationship of the number of eggs obtained on ovitrap paddles to the actual adult population is not clearly defined, the values presented suggest a rapid increase in the oviposition potential of the developing population. Corresponding increases in oviposition indices, based on percentage of positive ovitraps, were obtained in several preparatory areas in the recent U.S. eradication program (Jakob and Bevier, 1969).

It should be noted that treatment of Chunky was made without any supportive pre- or posttreatment control activities, such as source reduction or insecticide applications. Additionally, treatment was made after plant growth had started and, undoubtedly, some containers with eggs were missed in the many patches of blackberry briars, smilax, honeysuckle, and other luxuriant growth encountered. Although the number of positives in treated Chunky approached that of untreated Hickory at 8, 9, and 11 weeks after treatment, the results of the ovicide application are encouraging in view of the delay obtained in the population buildup.

TABLE 2.—Results of ovitrap surveillance in ovicide field trials against *Ae. aegypti*, Mississippi, 1969.

Week No.	No. Positive Ovitraps			No. Eggs in Ovitraps		
	Chunky[1]	Hickory[2]	Meridian[2]	Chunky	Hickory	Meridian
18	0	3	0	...	26	....
19	1	2	1	5	17	4
20	1	2	4	2	26	51
21	1	4	5	23	46	60
22	2	11	9	20	130	156
23	7	10	11	184	409	333
24	9	10	22	184	251	848
25	3	11	18	70	263	683
26	14	17	30	248	304	874
	38	70	100	736	1472	3009

[1] Treated during week 15.
[2] Untreated controls.

CONCLUSIONS

Treatment of breeding containers with

ovicide during the cooler months when most of the population is in the egg stage has been shown to be an effective new approach to *Ae. aegypti* control in field trials in south Florida and Mississippi. Application of an aqueous mixture of ethanolamine:Duomeen L-11 dramatically reduced the number of breeding sites producing larvae. Integration of this technique with other control procedures will exert pressure on the population at all times. The value of ovicidal applications during the breeding season as an adjunct to residual larvicide treatments warrants study in an organized control scheme.

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A reviewer of Albert Miller's paper, "Phlebotomine Sand Flies in Louisiana (Diptera:Psychodidae)," (pp. 180–187) brought up a question on nomenclature which the Editor referred to the author. In resolving the question Dr. Miller wrote a rather interesting letter which is reproduced in part below, since it concerns a common difficulty in taxonomy. I am sure it will be appreciated by other taxonomists, and will offer some sidelights on their difficulties to persons who are not always appreciative of the rules by which taxonomists have to work. . . . Ed.

". . . In regard to the question concerning *'vexator'* and *'vexatrix'*: This is just that troublesome subject sex (i.e., gender) rearing its head at the very outset and the proverbial battle not being compromised until page 12. Changing the generic designation from *Phlebotomus* to *Lutzomyia* requires a corresponding change in the gender of all the original species names, and this is more conspicuous but less apparent (that's possible? – better, less understandable or recognizable) in the case of *vexator* than in the names changed simply from *-us* to *-a*. *Vexatrix* is synonymous with *vexator* only as 'woman' is synonymous with 'man' (as, I suppose, the Women's Liberation League holds), but I will gracefully concede that it is advisable to treat *vexatrix* as exceptional in the initial list.

". . . If further justification, other than pure-minded reviewers, is needed, the double *vexatrix* is a double innovation publication-wise and requires synonymizing with old-shoe *Phlebotomus vexator* ensconced in the earlier literature. Incidentally, the listing of this species in Stone *et. al.*'s Catalog of Diptera under the subgenus *Brumptomyia* instead of *Lutzomyia* as one might expect is an apparent inconsistency which I'm not sure I fully understand. Since the paper is not a taxonomic treatise, that need not be mentioned, and the question can be left to the specialists and/or their psychiatrists.

"Sincerely, the perpetrator (*nec* perpetratrix),

ALBERT MILLER"