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EVALUATION OF FIVE PERCENT METHOXYCHLOR GRANULES AS A PRESEASON LARVICIDE

VAUGHN E. WAGNER [1]

Dutchess County Department of Health, Poughkeepsie, New York

INTRODUCTION. The *Aedes* group of mosquitoes constitutes a major control problem not only for the upland region of New York State but also the other northeastern States. A non-persistent larvicide, having the capability of slow release would be of great value in combating these early spring *Aedes*. With these criteria in mind, a 5 percent methoxychlor granular formulation supplied by E. I. du-Pont De Nemours and Co., Wilmington, Delaware, was chosen for an evaluation study in Dutchess County, New York. A literature survey completed at this time revealed no previous field trials with this formulation as a preseason larvicide.

METHODS AND MATERIALS. In February, 1969, nine water sites ranging from one-tenth acre to one acre were chosen for the study. These areas were consistently heavy producers of *Aedes* and were thoroughly mapped as to area and location in Dutchess County. All sites were closed landlocked ecosystems which prevented insecticide runoff during the spring thaw.

Field evaluations were conducted during the month of March, applying the 5 percent methoxychlor granules at the rate of 1.0 lb. actual/acre. The first preseason application was conducted March 11, 1969, at four woodland pool areas. A back pack unit registered under the trade name *Mitey Mite* (Buffalo Turbine Agricultural Equipment Co., Inc.), calibrated at 1.2 lbs./min. dosage rate, was used to apply the granules. Further evaluations were conducted March 24, 1969 at three additional woodland pools, one woodland swamp, and one meadow pool. A truck mounted Model CS Buffalo Turbine (Buffalo Turbine Agricultural Equipment Co., Inc.) calibrated at 5.0 lbs./15 secs was used to apply the granules. Pertinent data collected during both evaluations are found in tables 1 and 2. A recheck every 10 days of the nine sites was initiated April 1, 1969 and continued to June 15, 1969. Observations of nontarget organisms were also recorded.

[1] Medical Entomologist, Dutchess County, Mosquito Control, 22 Market Street, Poughkeepsie, New York.

TABLE 1.—Data on application of 5% methoxychlor granules made on March 11, 1969.

Site Number	Site Description	Air Temp./ Water Temp.	Water Condition	Rate (actual) Application
1	1/10 acre woodland pool	18° F./32° F.	ice base 6" snow cover	.10 lbs.
2	1/10 acre woodland pool	18° F./32° F.	ice base 6" snow cover	.10 lbs.
3	1/2 acre woodland pool	20° F./32° F.	ice base 4" snow cover	.50 lbs
4	3/4 acre woodland pool	22° F./32° F.	ice base 4" snow cover	.75 lbs.

RESULTS AND DISCUSSION. Although first instar larvae were collected from sites located throughout Dutchess County on March 20, 1969, systematic rechecks of the treated areas did not begin until April 1, 1969. On April 23, 1969 one *Aedes stimulans* (Walker), third instar larva, was collected from site 1. At site 9, five *Aedes canadensis* (Theo.), third instar larvae, were collected. During the month of May no mosquito larvae were collected from the nine sites. By May 12, 1969 two sites had dried completely with the remaining seven sites in varying degrees of desiccation. On May 20, a 1.16 inch rainfall resulted in reflooding of all nine sites. Third and fourth instar larvae were collected at sites 3 and 4 on June 2, 1969. They were identified as *Aedes vexans* (Meigen) and averaged approximately 2.5 larvae per dip for the two sites. Also, adult *A. vexans* were observed at sites 3, 5, 7, and 9. Landing count observations resulted in 10 adults/min., 3 adults/min., 8 adults/min., and 3 adults/min., respectively.

At no time during the course of the investigation was there any observed mortality of vertebrate life forms. Of the Amphibia, *Rana* spp. were observed to undergo complete metamorphosis from tadpole to adult at sites 5 and 6 (1.0 lb./acre). Reptilia, represented by *Chrysemys* spp., were observed at sites 1 and 5 throughout the experiment. As all sites underwent intermittent drying and flooding during the year, no fish were present. The emergence of vegetation at each site

TABLE 2.—Data on application of 5% methoxychlor granules made on March 24, 1969.

Site Number	Site Description	Air Temp./ Water Temp.	Water Condition	Rate (actual) Application
5	1/4 acre woodland swamp	39° F./38° F.	no ice	.25 lbs.
6	1 acre swamp	39° F./32° F.	ice base no snow cover	1.00 lbs.
7	1/10 acre woodland pool	41° F./40° F.	no ice or snow cover	.10 lbs.
8	1/10 acre meadow pool	43° F./40.5° F.	no ice or snow cover	.10 lbs.
9	1/4 acre woodland pool	43° F./32° F.	ice cover no snow	.25 lbs.

TABLE 3.—Comparison of larval samples from two sites untreated in 1968 and treated in 1969 with 5 percent methoxychlor granules.

Site Number	Mosquito Larvae per Dip April, 1968	Total Count	Instar	Mosquito Larvae per Dip April, 1969	Total Count	Instar	% Reduction
1	2.8	2 *Aedes canadensis*	pupae				
		3 *Aedes canadensis*	3rd & 4th				
		16 *Aedes stimulans*	pupae				
		7 *Aedes stimulans*	3rd & 4th	.10	1 *Aedes stimulans*	3rd	97.5%
2	5.7	22 *Aedes canadensis*	3rd & 4th	0	0	0	100%
		63 *Aedes stimulans*	3rd & 4th	0	0	0	

during the study occurred without any observed phytotoxicity. On April 23, 1969 a series of water samples taken from site 9 showed the presence of dipteran larvae later identified as the chaoborid gnat, *Mochlonyx* sp. Approximately one month later, the presence of *Mochlonyx* pupae and adults was observed at sites 5 and 9. Other insect life observed at the experimental sites belonged to the following families: Sialidae, Gerridae, Dytiscidae, and Corixidae. Also observed during the week of April 21, 1969 were adult Simuliidae, at sites 3, 4, and 9.

The results of these field evaluations indicate that the use of methoxychlor granules at the rate of 1.0 lb./acre results in substantial control of early season *Aedes* mosquito larvae. While it is true that the nine sites treated with the granules remained practically free of *Aedes* mosquito larvae during April and May, the significance of this can be better understood after basic comparisons are made between the data collected from the experimental sites and the corresponding control sites in 1969 and base line data from the same sites in 1968.

A study of the data collected in 1969 from 9 sites indicated that larvae were present at each site. Using a ten dip per site standard, the larvae ranged from 1 to 10 per dip with a 7.7 average for all control sites. This compares with a .7 larva per dip average for the nine treated sites. The sample population for the nine experimental sites during April and May was approximately 91 percent below those of the control sites.

A comparison of data collected from the same nine sites during the same time period in 1968 indicated a reduction in mosquito larvae density. The records show an average of 6.1 mosquito larvae per dip in 1968 as opposed to the .7 average collected during April and May of 1969. This is a reduction of 5.4 larvae per dip or 88.6 percent. Table 3 shows a comparison study for two sites (1 and 2) that were treated March, 1969 and data collected at the same untreated sites in 1968.

The results of this work indicate that preseason application of 5 percent methoxychlor granules at the rate of 1.0 lb./acre to woodland pools as a preseason larvicide adequately controls first generation, early season *Aedes* mosquitoes. The presence of *Aedes vexans* in the larval and/or adult stage at sites 3, 4, 5, 7, and 9 by June 2 indicates the limits of effectiveness for this formulation under these conditions. The presence of five third instar *Aedes canadensis* larvae at site 9, April 23, 1969 indicates inadequate coverage as all five larvae were sampled from an isolated backpool. No larvae were collected from the remaining seven sites systematically sampled during April and May, 1969.

CONCLUSION. Five percent methoxychlor granules applied as a preseason larvicide for control of early season *Aedes* mosquitoes proved to be an effective, safe and nonpersistent insecticide. The results of the study showed that at the dosage rate of 1.0 lb./acre the sample populations collected at the study sites were approximately 91 percent below those collected at the control sites. Also a reduction of 88.6 percent in the larval sample population occurred at the nine treated sites in 1969 as compared with samples taken at the same untreated sites a year before. The effectiveness of the methoxychlor granules as a preseason larvicide depends upon thorough application of the insecticide to the surface area of the site being treated. This was a problem due to the fact that at the time of treatment the area had an ice and snow cover that obscured the actual boundaries of the site.

Effectiveness also depends upon the residual effect of the methoxychlor impregnated granules. The empirical observations conducted at the treated sites during the study period, in conjunction with past larval surveys, indicate that the

residual effect is of sufficient duration to control first generation *Aedes*. However, further research should be conducted to determine more precisely the amount of residue and the duration of its effectiveness, resulting from application of 1.0 lb./acre and lower dosages, of methoxychlor.

EVALUATION OF A FUSELAGE-MOUNTED SPRAY BOOM FOR ULTRA-LOW VOLUME APPLICATION OF INSECTICIDES FOR MOSQUITO CONTROL [1]

B. MICHAEL GLANCEY, H. R. FORD AND C. S. LOFGREN
Entomology Research Division, Agr. Res. Serv., U.S.D.A., Gainesville, Florida 32601

Ultra-low volume (ULV) application of insecticides, that is, the application of undiluted insecticide or highly concentrated formulations (>20%), has made possible the development and use of smaller and more compact aerial spray equipment. Examples are the compressed air systems described by Dearman *et al.* (1965) and Glancey *et al.* (1966) and the electric motor-driven pump system of Burgoyne *et al.* (1967). Also, we designed a system similar to that of Burgoyne *et al.* and operated it off a 12-volt battery so that a tie-in to the electrical system of the aircraft was not necessary. This system proved portable and adaptable and was used on a UH-1D helicopter by Lofgren *et al.* (1968) in Panama in tests for control of anopheline mosquitoes. The spray rigs just described depend on a conventional spray boom affixed to the wings of the aircraft which necessarily limits them to planes already equipped for aerial spraying (or requires the installation of a boom). Theoretically wing booms function primarily as a means of getting the insecticide spray into the vortices of air produced at the wing tips so wider swaths can be attained.

During our studies in mosquito control, we have concluded that wing booms, at least on larger aircraft, might be unnecessary with the ULV technique provided small droplets (<100 microns) are produced. This conclusion is based on the following reasoning. Control of adult mosquitoes is usually carried out in locations such as residential areas and marshland wildlife refuges where larger dosages of insecticide that give long residual control are objectionable. With the low doses that are required in these areas, control depends primarily on direct contact of the insecticide spray droplets with the mos-

[1] Mention of a proprietary product in this paper does not constitute an endorsement of this product by the U.S.D.A.