DURSBAN AND ABATE CLAY GRANULES FOR LARVAL MOSQUITO CONTROL IN ALBERTA

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ABSTRACT. Abate 4E (0, 0, 0′, 0′—tetramethyl-0, 0′ thiodi-p-phenylene phosphorothioate) adsorbed to bentonite (20–60 mesh) and Dursban M 3019 (O, O-diethyl-0-3, 5, 6-trichloro-2-pyridyl phosphorothioate) adsorbed to Attapulgus clay (16–30 mesh) were found to be effective mosquito larvicides when applied at the rate of 2 lb clay/acre (0.05 lb active ingredient/acre). A list of 10 species of *Aedes* collected from the study area is provided.

In the last few years several workers have been engaged in studying different aspects of mosquito control for the City of Edmonton, Alberta, Canada. Klassen and Hocking (1963) suggested that the mosquitoes move along the river valley into the city and have reported upon the influence of a deep river valley system on the dispersal of *Aedes* (Klassen and Hocking, 1964). Population studies on Edmonton mosquitoes were made by Wada (1965) who reported 26 species of mosquitoes from around the city.

Unpublished data from this laboratory using field-collected *Aedes* larvae exposed to insecticides for 24 hours indicate that the LD_{50} for DDT is approximately 0.001 ppm, for Abate is approximately 0.0001 ppm and for Dursban is less than 0.0001 ppm. Preliminary field tests using emulsifiable concentrates of Abate and Dursban applied at a rate of 1 oz. active ingredient/acre gave good control with both insecticides. However, for several reasons, including local climatic conditions, a desire to minimize insecticide drift and the occurrence of brush in many of the ponds to be treated, it is considered desirable to have mosquito larvicides adsorbed on clays for aerial applications done around Edmonton.

The present investigations were carried out to test the effectiveness for control of mosquito larvae of the organophosphorus compounds Abate 4E (0, 0, 0′, 0′-tetramethyl-0, 0′-thiodi-p-phenylene phosphorothioate) adsorbed on bentonite and Dursban M 3019 (0, 0-diethyl-0-3, 5, 6-trichloro-2-pyridyl phosphorothioate) adsorbed on Attapulgus clay.

METHODS. First instar mosquito larvae were found on April 7, 1969 and by April 15 some larvae had developed to the third instar. Control operations started on April 19, 1969. All control measures were carried out for or by the City of Edmonton Parks Department and under the supervision of Mr. J. D'Aoust. Aerial application was done with a helicopter and the insecticide-bearing clays were applied at 2 lb clay/acre (0.05 lb active ingredient/acre). Abate was adsorbed on bentonite (20–60 mesh) and Dursban was adsorbed on Attapulgus clay (16–30 mesh). Both insecticides were obtained by the City of Edmonton Parks Department as emulsifiable concentrates and a local firm adsorbed the insecticides on the appropriate clays following methods outlined by the manufacturers.

In these investigations 2 square miles were selected in Dursban treated area, 2.5 sq. miles in Abate treated area, and two 0.5 square mile in the untreated area. These study areas were surveyed and almost all the ponds in each area were marked. The ponds were divided into various types but only data from non-wooded, field ponds which did not dry up are reported here. Weekly observations were made on the number of larvae and pupae in each pond in all the study areas during the season. For sampling, 10 dips per pond were taken and the numbers of larvae and pupae were recorded. Some larvae and pupae were taken to the laboratory for identification. Collected larvae were separately reared to adults and the fourth larval skin was mounted on slides to facilitate identification. The identifica-

tion of larvae followed Carpenter and LaCasse (1955); adults were identified mostly after Graham (1969). Data on the species found are given in table 1.

RESULTS. Only seven ponds in the untreated area met the criteria for use in this experiment—that is, were non-wooded field ponds containing mosquito larvae and did not dry up during the season. Of the treated ponds 16 in the Abate treated areas and 10 in the Dursban treated areas met the above criteria. Using the data from the control ponds and the number of larvae + pupae observed in each pond before spraying, the number of larvae expected in the treated ponds has been calculated for each date on which the pond was sampled. The numbers observed and expected along with the χ^2 values are presented in tables 2 and 3. The data show that the application of Dursban and Abate resulted in a significant decline in the mosquito populations.

TABLE 1.—Species of larvae and pupae collected from the untreated study areas.

Species	May 8	May 14	May 21	June 4
Aedes				
stimulans	X		X	X
flavescens	X		X	X
riparius	X			
hexodontus	X			
pionips	X	X		
punctor	X			
fitchii			X	
increpitus			X	
excrucians			X	X
vexans			X	

To compare Dursban with Abate a similar analysis was done (table 4) using the data from the Abate ponds to calculate the expected number of larvae + pupae for the Dursban ponds. For this purpose the ponds were compared by consideration of the number of days after spraying rather than by calendar date. The results indicate that in one test area the Dursban treatment gave significantly better control ($p<1\%$) at all post treatment dates. The same was true in the second study area 4 days after treatment but at subsequent times the differences were not significant.

SUMMARY AND DISCUSSION. Both Abate and Dursban adsorbed on clays and applied to ponds gave a significant reduction in the number of mosquito larvae and pupae observed in these ponds. During 1969 these reductions in larval populations in the treated ponds lasted throughout the breeding season. A statistical comparison of the populations encountered in the Dursban-treated ponds compared with the Abate-treated ponds indicated that Dursban was slightly more effective.

From the results of the present study it appears that the advantages to be gained by application of insecticides adsorbed on granular clays are available by use of Dursban M adsorbed on Attapulgus clay or Abate adsorbed on Bentonite. Both preparations in this study were used shortly after their formulation and no data were obtained on the shelf life of these preparations.

In the last few years it has been shown that Dursban and Abate are very effective in mosquito larval control. Ludwig and

TABLE 2.—Results of treatment of 16 ponds with Abate. Expected number of larvae + pupae/10 dips calculated from changes in control ponds and the number of larvae + pupae in ponds prior to treatment. Ponds treated on May 3, 1969.

Date	Avg/10 dips		χ^2	significance level
	Expected	Observed		
May 2		38.1		
May 7	33.9	6.8	369	<.1%
May 15	21.3	2.6	316	<.1%
May 22	30.4	2.4	443	<.1%
May 28	12.9	2.4	188	<.1%

TABLE 3.—Result of treatment of ponds with Dursban. Expected number of larvae + pupae/10 dips calculated from changes in control ponds and the number of larvae + pupae in ponds prior to treatment. Data in part A are from 5 ponds treated on April 21 and in Part B from 5 ponds treated on May 2, 1969.

A	Avg/10 dips			
Date	Expected	Observed	χ^2	significance level
Apr. 18		102.2		
22	102.	12.8	450	<.1%
29	102.	0.	511	<.1%
May 6	84.8	1.8	408	<.1%
13	52.1	0.	207	<.1%
B	Avg/10 dips			
Date	Expected	Observed	χ^2	significance level
May 2		12.0		
6	10.9	4.8	24	<.1%
13	6.7	0.	34	<.1%
28	4.1	0.	20	<.1%

McNeill (1966) found, after several years of field testing, that Dursban had good potential in open septic ditches and stagnant water, and when applied at 0.05 lb/acre it gave residual control of *Aedes sollicitans* larvae for 4 weeks. Similarly Lewis *et al.* (1966) reported effective residual control for 23 days with the same insecticide at 0.1 lb/acre when applied to ponds. It was also reported that Dursban provided control of mosquito larvae for 144 days when it was applied at the rate of 1 p.p.m. to livestock waste disposal lagoons (Steelman *et al.*, 1967). The residual effect of Dursban is most probably due to the fact that it is absorbed on the organic matter as was claimed by McNeill *et al.* (1968).

Similarly, Abate was reported to be as effective as Dursban under conditions of heavy vegetation and high organic pollution (Sjogren and Mulla, 1968). Glancey

TABLE 4.—Comparison of Dursban with Abate. Expected number of larvae + pupae/10 dips was calculated from changes in the Abate treated ponds and the number of larvae + pupae in the ponds prior to treatment with Dursban. Data in part A are from 5 ponds treated on April 21 and in Part B from 5 ponds treated on May 2, 1969.

A	Avg/10 dips			
Date	Expected	Observed	χ^2	significance level
Apr. 18		102.2		
22	26.6	12.8	263	<.1%
29	12.3	0.	65	<.1%
May 6	6.1	1.8	35	<.1%
13	6.1	0.	30	<.1%
B	Avg/10 dips			
Date	Expected	Observed	χ^2	significance level
May 2		12.0		
6	3.2	4.8	29	<.1%
13	1.0	0.	5	n.s *
28	0.7	0.	4	n.s

* Not significant.

et al. (1968) showed that Abate was an effective residual larvicide and complete kill of the larvae was obtained for 18.3 to more than 34 weeks when 1.0 p.p.m. of the emulsifiable concentrate and granular formulations were used. They also found that Dursban gave complete kill for much shorter time than Abate (a maximum of 5.3 weeks at 1 p.p.m.).

The studies by Patterson and von Windeguth (1964), von Windeguth and Patterson (1966), Ferguson *et al.* (1966), Mulla (1961) and Keith and Mulla (1966) show the relative safety and hazards of these insecticides to non-target organisms.

From the present findings and those of other workers it appears that both Dursban and Abate are good mosquito larvicides and could be recommended as replacements for DDT.

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PAGE CHARGES

Authors and their agencies are reminded that at the Annual Meeting in Portland, Oregon on Feb. 25, 1970, it was voted to increase the page charges for *Mosquito News* from $15.00 to $20.00 for members and from $25.00 to $35.00 for non-members, *beginning with the issue for March, 1971* (Volume 31, No. 1). This action was duly reported in the Minutes, as printed on page 276 of Vol. 30, No. 2, for June, 1970.