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USE OF A CONTROLLED RELEASE LARVICIDE IN SOUTHERN MARYLAND[1]

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ABSTRACT. A new Dow Chemical Company formulation, DURSBAN® 10 CR was used to larvicide selected sites in southern Maryland during 1977. Excellent control was achieved in properly treated sites for the 12 to 18 weeks of observation with no recorded effect on non-target organisms.

The concept of a controlled release formulation as a mosquito larvicide was explored by the U.S. Army in 1966 and tested periodically by that agency thereafter (Nelson et al. 1976). In August, 1976, Dow Chemical Company, Midland, Michigan, introduced Dursban® 10 CR insecticide[2], a controlled release formulation of 10.6% chlorpyrifos in an inert, pelletized carrier, with an EPA registration. The label states that one application will control early instar mosquito larvae for 1 breeding season by maintaining a level of active ingredient of 1.5 ppm. The material is recommended for use in temporary or permanent pools, or for prehatch or flooded area treatment.

The advantages of a relatively safe, long acting mosquito larvicide, without the stigma of the persistent chemicals of the DDT era are obvious. In the average larviciding program chemicals represent 5 to 10% of costs with the majority of expenses in labor and transportation. Depending on rainfall, many breeding areas require weekly surveys and treatment to prevent hatching.

The mosquito control program in Maryland has been carefully monitored to avoid the susceptibility problems encountered in other areas, and larvicides have been restricted to temephos, Flit MLO, and fuel oil (Joseph 1976). Therefore, the use of a new chemical was approached cautiously.

In 3 southern Maryland counties there are numerous, scattered breeding areas. Surveys for mosquito breeding and application of larvicides are performed by seasonal personnel who are given training by the Area Entomologist.

For the 1977 program, we purchased a small quantity of Dursban® 10 CR for use in southern Maryland. The label has a chart showing pounds of Dursban® 10 CR required to treat various volumes of water in gallons, with instructions for calculating the volume of the breeding area in cubic feet and then converting to gallons. Since the estimation of either gallons or cubic feet would appear equally difficult, the final conversion to gallons appears unnecessary. For our training, a chart was prepared showing the weight of chemical

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[1] The opinions presented are those of the author and may not reflect the views of the Maryland Department of Agriculture.

[2] Mention of proprietary products is for identification only and does not imply endorsement by the Maryland Department of Agriculture.

required for various volumes of water in cubic feet as shown in Table 1.

The Prehatch Treatment section of the label advises a dosage based on anticipated volume of water in a breeding area. However, the Flooded Area Treatment section advises estimating the *actual* volume of water present for determining the amount of chemical required. Since the volume of water in most temporary pools in our area fluctuates considerably during the summer, there may be a significant difference in the volume of a breeding area depending on the amount and frequency of rainfall. In our training we emphasized estimating the maximum anticipated volume of water to calculate the amount of chemical required, so that adequate treatment would be provided in times of flooding.

We planned to monitor each treated site at weekly intervals during the mosquito breeding season. A simple form was devised to record pertinent data on size, location, mosquito species and non-target organisms.

SELECTION OF SITES

Wetlands (coastal marshes) were excluded because the Maryland Department of Natural Resources restricts the use of chemicals in wetlands. No pesticides are allowed in areas adjacent to oyster beds, and only temephos emulsifiable concentrate in other wetlands. The following arbitrary criteria were established for selection of sites:

1. Known breeding areas with more than 1 brood per summer.

2. Relatively shallow breeding areas. Since dosage is based on volume of water

Table 1. Application rate for Dursban 10 Cr
Based on label rates of 1.5 ppm or 3.2 pounds per acre-inch of water

For large pools

Amt of 10 CR	Volume of Breeding Area	Amt of 10 CR	Volume of Breeding Area
ounces	*cu. ft.*	*pounds*	*cu. ft.*
1	71	1	1150
2	142	2	2300
3	213	3	3400
4	280	4	4550
5	350	5	5700
6	430	6	6800
7	500	7	8000
8	570	8	9100
9	640	9	10200
10	710	10	11400
11	780	11	12500
12	850	12	13600
13	920	13	14800
14	1000	14	15900
15	1070	15	17000

For small pools

To treat 1 sq ft

Depth	*# of Pellets*
1″	12
3″	36
6″	72

treated and Dursban® 10 CR at $4/lb. is relatively expensive, large deep pools were excluded. For example a 5-ft deep sewage lagoon would cost $768/acre (based on a rate of 3.2 lbs./acre in.) as compared with $17 for treatment with a conventional larvicide, Dursban M.

3. Areas where access is difficult or travel time is expensive. These are the areas that would provide the greatest saving in manpower and transportation.

During 1975, a year of abundant rainfall for southern Maryland, temporary forest pools provided the principal breeding areas for floodwater mosquitoes, and we had anticipated using this type of habitat for the 10 CR evaluation. However, rainfall during 1976 and 1977 was below normal during the summer and forest pools either remained dry or drained too rapidly to allow larval development. The most consistent breeding areas during these years were roadside drains with no outlet or with outlet blocked by fill or debris.

Seventeen sites were selected ranging in size from 19 ft³ to 45,000 ft³ (Table 2). The types of habitat are summarized as follows:

Roadside ditch	8
Forest pool	3
Open grassy pool	2
Urban storm drain	1
Sewage sedimentation chamber	1
Dredge fill pool	1
Dredge fill ditch	1

The roadside ditches selected were in rural areas where many ditches have no apparent outlet. This type of habitat has produced floodwater mosquitoes consistently for the past 3 years in southern Maryland. Where possible, treated plots were located near similar untreated plots. Personnel were instructed to observe and

Table 2. Dursban® 10 Cr sites—Southern Maryland—1977

Site[1]	Habitat	Vol. ft.[3]	Date Treated	No. of wks negative[3]	Date Terminated	Results
CH-1	grassy pool	750	6/14	18	10/19	No larvae
CH-2	storm drain	940	6/15	0	6/22	Outlet unblocked
CH-3	road ditch	700	6/15, 16[2]	9	8/23	Ditch filled in
CH-4	forest pool	300	6/15	17	10/12	No larvae
CA-5	grassy pool	2,500	6/29	16	11/8	*Cx.* larvae 17th week
CA-6	dredge fill	7,500	6/29	16	11/8	*Cx.* larvae 17th week
CA-7	dredge fill ditch	1,400	7/25	17	11/8	No larvae
SM-8	road ditch	250	6/20	13	9/21	No larvae
SM-9	road ditch	2,300	6/20	13	9/21	No larvae
SM-10	road ditch	9,000	6/21, 22[2]	13	9/21	No larvae
SM-11	road ditch	2,500	6/21	13	9/21	No larvae
SM-12	road ditch	19	6/22	18	10/28	No larvae
SM-13	forest pool	45,000	6/22	0	6/27	Outlet unblocked
SM-14	forest pool	30,000	6/30	2	7/14	Area graded for constr.
SM-15	road ditch	2,300	6/30	12	9/21	*Cx.* larvae 13th week
SM-16	sewage sump	2,200	7/12	17	10/28	No larvae
SM-17	road ditch	6,000	7/16	17	10/28	No larvae

[1] CH = Charles County; CA = Calvert County; SM = St. Mary's County.
[2] Second date is retreatment because of inadequate dosage.
[3] Negative means no 3rd or 4th instar larvae.

collect mosquitoes and non-target organisms.

Most of the sites had fresh water species, but 2 of the sites adjacent to a recent dredge fill had salt marsh mosquitoes. A list of species and the number of sites in which collected ( ) is shown. Some sites had more than one species.

Aedes vexans (7) *Culex pipiens* (5) *Psorophora confinnis* (4) *Cx. salinarius* (2) *Ae. sollicitans* (2) *Ae. cantator* (2) *Ps. howardii* (1) *Cx. restuans* (1)

TREATMENT AND SAMPLING

The 10 CR was carried in glass bottles containing ½ ounce to 1 pound of material. The pellets are uniform in size and are easy to spread. Ditches were treated with salt shaker type bottles. Wide plots were treated using seed sowers.

Personnel were instructed to reinspect the site 1 or 2 days after treatment to verify complete kill of mosquito larvae. If larvae were still active, the volume was reestimated and additional 10 CR added, if appropriate. Two of the 17 sites still had active larvae after 24 hr. These sites had been underdosed and were treated with additional material. Two other sites had previously undetected outlets and a heavy rain during the first week washed away most of the pellets. These last two were discountinued as 10 CR plots. Two other sites were altered by construction and were discontinued. One site was overdosed because survey personnel calculated the volume for a cylinder when the actual shape was a cone so that the treatment of 3.6 lbs. instead of the 1.2 lbs. resulted in a dosage of 4.5 ppm vs. 1.5 ppm. This site should not have been selected because of the depth of 14 feet but once treated, was followed for the season. The overdose killed notonectids for 4 weeks, but did not kill tadpoles. Sites were sampled weekly using standard enamel or plastic dippers. From 10 to 30 dips were taken from each site.

The extremely dry weather during August resulted in loss of water or complete drying of many of the sites for 3 to 5 weeks. However, all of these flooded again during September and were followed through late September or October. One site retained water throughout the summer. This was considered our best site because of previous breeding records, continuous but fluctuating water level, and continuous breeding of both *Aedes* spp. and *Culex* spp. in similar pools nearby. During the 12th week, 1st instar *Cx. restuans* were found but these apparently did not develop as the area was negative 2 days later. Three other sites had egg rafts on one or more visits but again the larvae apparently died in early instars as subsequent samples were negative.

EVALUATION

The results were excellent with 100% control for the 12 to 18 weeks of observation in adequately treated plots. Of the 13 sites studied through September or October only one, SM-15, developed larvae, 3 *Cx. pipiens* in 10 dips, on September 21, 13 weeks after treatment.

Three sites in Calvert County were followed through November. These three were flooded to overflowing several times during October and once in November. On November 8, 16 weeks after treatment, 2 of these sites were positive but with only a few larvae. One site had 7 larvae (*Cx. pipiens* and *Cx. restuans*) in 30 dips and the other had 3 *Cx. restuans* in 20 dips.

The following non-target organisms were observed in treated plots: corixids, notonectids, Odonata nymphs, dytiscids, gyrinids, amphipods and tadpoles. Except for the one overdosed sewage basin where notonectids were killed and did not reappear for 4 weeks, no non-target kills were noted.

This material appears to have excellent potential for those programs still using chemical larvicides. During 1978 we plan to start treatment during March and April so that the treatment can be evaluated over a longer time period.

ACKNOWLEDGMENTS. The author

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A NEW RECORD OF *AEDES CANTATOR* FROM THE TIDAL ZONE OF SOUTHEASTERN JAMES BAY, QUEBEC

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ABSTRACT. Very high densities of *Aedes cantator* larvae were observed all along the tidal zone of the southeastern part of James Bay, Quebec. Thus, its distribution is greatly extended westwards: it was formerly known only on the Atlantic Coast, from Goose Bay to Virginia. The ecology of larval breeding sites of *Ae. cantator* are analysed and discussed. The associated mosquito species are *Ae. implicatus* during the spring and *Ae. dorsalis* which follow in the same larval habitats during the summer. Two possible mechanisms of dispersal of *Ae. cantator* to James Bay are suggested.

RÉSUMÉ. *Aedes cantator* a été observé en très grande densité le long de la zone littorale de la Baie de James, jusqu'à Eastmain. Son aire connue jusqu'alors formait une bande littorale atlantique, de Goose Bay jusqu'en Virginie. L'étude écologique des gîtes à larves d'*Aedes cantator* de la Baie de James est présentée et discutée. Les deux espèces culicidiennes associées sont *Ae. implicatus* au printempts et *Ae. dorsalis*, qui succède en été à *Ae. cantator* dans les mêmes gîtes. A la suite des résultats obtenus, les auteurs proposent une nouvelle aire de répartition pour cette espèce.

Aedes (Ochlerotatus) cantator (Coquillett) is confined to the Nearctic region. Its distribution was thought to be restricted to the Atlantic coastal zone, from Goose Bay, Labrador (Canadian National Collection (CNC) Ottawa, collected in 1949 by R. P. Thompson), Newfoundland (Vockeroth 1954) and the Maritime Provinces (Twinn 1949) south along the eastern coast of U.S. (Horsfall 1955, Main et al. 1968, Evans and McCuiston 1971; Bickley et al. 1971) to Virginia (Gladney and Turner 1969). According to Horsfall (1955), "Larvae are found in shallow, sodded depressions when these are flooded by freshwater or by brackish water." Evans and McCuiston (1971) report that "according to Headlee (1945), *A. cantator* breeds in fresh, salt or brackish water but prefers water pools formed by rain or drainage."

This species has a springtime larval development (Bickley et al. 1971). Although Horsfall (1955) considers it as a multivoltine species, Saugstadt et al. (1972) note in Virginia that "*Aedes cantator* adults reached peak density in the spring and were present in very low numbers during the summer. This observation is in contrast to reports of its being a multivoltine species in other areas." But this far south there are 3 other saltmarsh species competing with *Ae. cantator*, and the climate is different. We observed larvae only during the spring (June 1977). On the other hand, adult specimens in the CNC, col-