THE EFFICACY OF PREFLOOD AND RESIDUAL APPLICATIONS OF TWO FORMULATIONS OF METHOPRENE

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ABSTRACT. A 0.4% black sand granular and a briquet formulation of methoprene (Altosid®) were tested as preflood and residual applications in brackish water ponds against *Aedes taeniorhynchus* (Wied.). In the preflood applications, samples of the sand granular formulation at 0.02 lb. AI/acre were exposed to sun and rain for 2, 9, 16, and 23 days before flooding. In these tests the formulation remained effective for at least 2 days after being exposed. When tested at weekly intervals for residual activity, the granular formulation was not effective 7 days after initially flooded.

Preflood applications of the briquets at a rate of 1 per 100 ft², which had been exposed for 7, 14, 21, and 28 days before flooding, were still effective at 28 days. The unexposed briquets applied at the same dosage and tested at weekly intervals for residual activity remained effective for 31 days.

It has been shown (Schaefer and Wilder 1972) that methoprene or Altosid® is effective primarily against 4th instar larvae, and since it is usually not possible to treat when only 4th instar larvae are present, the applied material must have some residual action for optimum effectiveness in control operations. Also, a certain amount of residual action is desirable when controlling both continuous breeding mosquito species and flood water species where asynchronous hatching occurs as a result of expanding breeding areas due to prolonged rainfall or successively higher tides.

Early formulations of Altosid had a very limited period of biological activity, some as little as a few hours. More recently however, new formulation techniques (Schaefer et al. 1974) have lengthened the period of activity considerably. This is a report of preflood and residual applications of two new formulations of Altosid.

METHOD

The tests were conducted in a series of 16 specially constructed salt water test ponds which were previously described by Rathburn and Boike (1975). The ponds remained flooded throughout the testing period.

Since there would have been no control over the length of time the treatments were exposed before they were flooded if placed in the test plots, a simulated preflood treatment was devised. For these treatments, eight 5 by 7 in. plastic lids were buried about 1 in. below the surface of the ground in an open area not subject to flooding by rain or tide. The position of each lid was marked by stakes at each corner. Four samples of the 0.4% black sand granules, supplied by Zoecon Corp., each sufficient to treat a 200 ft² plot at a rate of 0.02 lb AI/acre were weighed and scattered on the ground above the plastic lid in an area approximately 4 by 6 in. in the center of the stakes which marked the position of the buried lid. Four samples of 2 briquets, each sufficient to treat the plots at a rate of 1 briquet per 100 ft², were also exposed in the same manner.

Two, 9, 16, and 23 days later in the case of the granules and 7, 14, 21, and 28 days later in the case of the briquets, one sample of each was removed along with the soil above the buried lid, placed in a pan and scattered over the test plot in which had been previously placed 5000–6000 colony reared 3rd instar *Aedes taeniorhynchus* (Wied.) larvae.

To determine the residual effectiveness of the preflood treatments of the exposed

granules and briquets, colony reared 3rd instar *Ae. taeniorhynchus* larvae were also added at weekly intervals to the plots originally treated with the granules or briquets. Treatments of the sand granular formulation at a rate of 0.01 lb AI/acre and the briquets at a rate of 1 per 100 ft^2, which had not been exposed prior to application, were also tested in the same manner at weekly intervals for their residual effectiveness.

The residual treatments without previous exposure were replicated in 2 to 4 plots; but because only 16 plots were available, the preflood treatments were tested in only single plots. One to 2 untreated or check plots were also included at each flooding as a control.

The first day pupae were formed and daily thereafter approximately 100–200 pupae were collected from each plot and placed in pint jars for emergence of adults. In a few treatments, the number of pupae collected was less than desired due to high pupal mortality prior to sampling. The jars were placed out-of-doors under a shelter to protect them from sun and rain and the viable adults were allowed to fly off. The percent emergence of viable adults was determined by subtracting the number of dead adults on the water surface from the number of cast pupal skins present and dividing by the total number of pupae sampled as determined by adding the number of cast pupal skins, the partially emerged adults, and the dead pupae.

RESULTS

From the data presented in Table 1, it appears that the black sand granular formulation containing 0.4% Altosid applied at a rate of 0.01 lb AI/acre gave 100% mortality of initial mosquito larval populations, but did not appear to have significant residual action 7 days later. In the preflood applications, the granular formulation at a rate of 0.02 lb AI/acre was still effective 2 days after exposure but was not effective after 16 days exposure. The data for 9 days' exposure were unfortunately lost because the mosquito larvae were destroyed by dragonfly naiads, which, with corixids, were very prevalent in the plots. None of the samples of the granular formulation which had been exposed for the various time intervals was effective 7 days after the initial flooding.

The unexposed briquet formulation at a rate of 1 per 100 ft^2 remained effective for 31 days after its initial application. In the preflood applications, the briquet formulation was still effective after being exposed for 28 days, and after 21 days' exposure it was effective for at least 7 days after its initial flooding.

Table 2 contains the rainfall and air temperature to which the granular and briquet formulations were exposed before they were added to the flooded plots and the water temperature, salinity, and pH to which they were exposed after they were flooded.

DISCUSSION

The preceding results are in general agreement with other authors who also show that the residual effects of various liquid and granular formulations of Altosid are generally less than 5 days and maybe as little as 1 day. Dame et al. (1976) in small plot studies of Altosid SR-10 at 0.025 and 0.05 lb AI/acre, showed that there was total prevention of eclosion by those pupae formed 3 days after exposure, and the effect lasted through the 8th day, for a total of 5 days.

Schaefer et al. (1973) in small plots studies of a 10% flowable liquid formulation of Altosid against *Culex pipiens quinquefasciatus* at a rate of 0.05 lb AI/acre obtained effective control for less than 1 day, while at rates of 0.25 and 0.5 lb AI/acre a high degree of biological activity lasted for 3 days. Therefore, where populations of mixed 3rd and 4th instar larvae are encountered, it appears that a higher dosage may be required for control than when all larvae are in the susceptible 4th instar. This is probably due to the fact that because of some chemical breakdown, an initial higher dose is required in order to have an effective dose for the time required for all larvae to reach the 4th instar.

Table 1. Results of preflood and residual applications of Altosid® granules and briquets against larvae of *Aedes taeniorhynchus* (Wied.) in small field plots.

Formulation	Dosage	No. days exposed before flooding	No. days after initial flooding	Treated		Untreated	
				Total pupae sampled	% viable adults produced	Total pupae sampled	% viable adults produced
0.4% Black Sand Granular	0.01 lb AI/acre	0	0	634	0	722	90.5
			7	470	70.0	683	97.6
			14	1351	97.0	353	98.4
	0.02 lb AI/acre	2	0	351	0	244	88.5
			7	449	82.2	399	100
			14	*	*	118	98.3
			21	461	95.2	275	83.6
		9	0	*	*	399	100
			7	*	*	118	98.3
			14	222	76.6	275	83.6
		16	0	390	87.2	118	98.3
			7	286	92.3	275	83.6
		23	0	196	72.5	275	83.6
Briquet	1/100 ft²	0	0	152	0	495	91.3
			14	444	0	604	98.5
			24	364	0	227	89.8
			31	599	6.0	683	97.6
			38	746	62.1	807	98.4
		7	0	300	0.7	244	88.5
			7	68	0	399	100
			14	*	*	118	98.3
			21	227	82.4	275	83.6
		14	0	139	0	399	100
			7	*	*	118	98.3
			14	185	45.4	275	83.6
		21	0	135	0	118	98.3
			7	170	0	275	83.6
		28	0	465	0	275	83.6

* No pupae formed—larvae destroyed by dragonfly naiads.

Schaefer and Dupras (1973) demonstrated the adverse effects of sunlight and temperature on ZR-515. Obviously, dosage rate, larval species, water pH and depth as well as formulation may also have pronounced effect on the length of residual activity. While an extended period of activity, such as was obtained here with the briquet formulation, may be detrimental in certain applications insofar as development of resistant strains and effects on nontarget organisms are concerned, a relatively short period of residual activity of even 2 or 3 days would be extremely beneficial in controlling asynchronous field populations.

References Cited

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Table 2. Exposure and test water conditions in preflood and residual applications of Altosid® granules and briquets.

No. days exposed before flooding	Exposure conditions: Rain in.	Exposure conditions: Avg air temp.–°F max.	Exposure conditions: Avg air temp.–°F min.	Water conditions[1]: Avg water temp.–°F max.	Water conditions[1]: Avg water temp.–°F min.	Water conditions[1]: Avg salinity ppt	Water conditions[1]: Avg pH
			Granular formulation				
2	0	84.0	76.0	92.5	80.7	13.2	6.1
9	0.9	88.1	78.5	91.8	79.3	11.2	6.1
16	3.7	89.1	78.1	89.3	76.3	12.6	6.0
23	5.8	88.7	77.6	89.3	74.4	15.7	6.0
			Briquet formulation				
7	1.9	85.4	76.1	92.5	80.7	13.2	6.1
14	2.4	87.5	77.7	91.8	79.3	11.2	6.1
21	5.1	88.4	77.7	89.3	76.3	12.6	6.0
28	7.3	88.2	77.7	89.3	74.4	15.7	6.0

[1] Water depth during tests varied between 6 and 12 inches.

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