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RESIDUAL ACTIVITY OF THREE SLOW-RELEASE TEMEPHOS FORMULATIONS AGAINST *AEDES AEGYPTI* LARVAE

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ABSTRACT. Residual effectiveness of plaster matrix formulations of temephos and temephos plus an emulsifier (Atlox® 3409F) were evaluated against *Aedes aegypti* larvae during an 8-wk period. Formulations of 2% and 5% (AI) Atlox with 5% (AI) temephos yielded 100% larval mortality for 8 wk. A 5% temephos formulation without the addition of the emulsifier produced 100% larval mortality through only 1 wk.

Slow-release larvicides have been recognized by operational mosquito control personnel as efficacious and cost effective. Such formulations can reduce the frequency and cost of insecticide application, especially in situations where large or inaccessible bodies of water require repetitive treatments. A variety of insecticides, including temephos, have been formulated to provide prolonged periods of control. Temephos has been evaluated in a variety of slow-release formulations against several mosquito species (Whitlaw and Evans 1968, Quick et al. 1981, Anderson et al. 1983, Das et al. 1983). Using a bioassay method to determine temephos concentration, Cilek et al. (1991) found that 100% larval mortality in *Aedes aegypti* (Linn.) was produced at concentrations above 0.012 ppm.

Biodegradable slow-release formulations incorporating materials such as plaster are compatible with current worldwide environmental concerns. Therefore, efforts at evaluating similar biodegradable substances for insecticide delivery should be encouraged. This study reports on the residual effectiveness of new slow-release plaster formulations of temephos against *Ae. aegypti* larvae.

Metal tanks (1.1 × 0.6 × 0.5 m deep) each containing 266 liters of tap water, were used in this study. Pelletized formulations of 5% (AI) temephos impregnated in either 95% plaster, 92.5% plaster with 2.5% (AI) Atlox® 3409F, or 90% plaster with 5% (AI) Atlox 3409F were received from Clarke Outdoor Spraying Co., Roselle, IL. According to the supplier of these formulations, Atlox (an emulsifier, containing a proprietary blend of anionic and nonionic surfactants) was added to produce an extended uniform release of temephos from the plaster matrix. Pellets from each formulation varied in weight and ranged in size from 4 to 5 mm wide to 9 mm long. Approximately 3.7 g of whole pellets were placed in each tank to make a concentration of 0.7 mg (AI) of temephos per liter. Treated and untreated tanks (control) were replicated 3 times. No organic matter was added to the tanks. The study was conducted in a heated greenhouse from January 19 to March 17, 1991. During this time air temperature ranged from 21.5 to 36°C, water temperature ranged from 17 to 25°C, and water pH ranged from 8.04 to 8.76.

One-liter water samples were collected from each tank 12, 24, and 48 h after treatment. Thereafter, 1-liter samples were collected at weekly intervals for 8 wk. Subsequent bioassays were conducted with *Ae. aegypti* larvae. Water was added to each tank the day before water collections to compensate for evaporation. Five minutes prior to sampling, the water in each tank was stirred slowly to attain equal mixing of dissolved temephos without disturbing the pellets at the bottom. Air temperature, water temperature, and pH (Accumet pH meter, Fisher Scientific Co., Cincinnati, OH) were recorded at each sample interval.

Mosquito larvae used in bioassays were from an insecticide-susceptible colony of *Ae. aegypti* that were initially received as eggs from the Medical and Veterinary Entomology Research Laboratory, U.S. Department of Agriculture, Gainesville, FL. Larval rearing used the methods of Munstermann and Wasmuth (1985). Bioassays were conducted by dispensing 25 late 3rd-instar larvae on filter paper strips with an eye dropper to facilitate counting, then placing the strips into separate 250-ml glass beakers containing 200 ml of water from each test tank. The strip was removed from the beaker and discarded after the mosquito larvae were released. Three aliquots of each water sample from each test tank per sample period were bioassayed. A similar subset of nontreated water samples served as controls. Twenty-four-hour larval mortality was determined by tapping the side of each beaker with a glass stirring rod. Larvae

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Table 1. Comparative mean (±SE) percent mortality of late 3rd-instar *Aedes aegypti* larvae against 2.5 and 5% (AI) temephos–plaster formulations with varying concentrations of Atlox® 3409F.

Formulation	Time after treatment						
	12 h	24 h	48 h	1 wk	2 wk	3 wk	4 wk
0% Atlox–temephos–plaster	100	100	100	100	86.7 ± 0.1	33.3 ± 0.1	30.7 ± 0.01
2.5% Atlox–temephos–plaster	100	100	100	100	100	100	100
5% Atlox–temephos–plaster	100	100	100	100	100	100	100

Table 1. Extended.

Formulation	Time after treatment			
	5 wk	6 wk	7 wk	8 wk
0% Atlox–temephos–plaster	34.7 ± 0.1	28.0 ± 0.2	42.7 ± 0.1	53.3 ± 0.04
2.5% Atlox–temephos–plaster	100	100	100	100
5% Atlox–temephos–plaster	100	100	100	100

that did not respond with a wiggling motion were recorded as dead. All bioassays were conducted at 25 ± 1°C.

Water samples from the 2.5 and 5% (AI) Atlox–temephos–plaster formulations produced 100% larval mortality of *Ae. aegypti* for each sample interval throughout the 8-wk test; the temephos–plaster formulation without the addition of Atlox resulted in 100% larval mortality through only wk 1 (Table 1). No mortality occurred in controls during the study.

Our results have shown that plaster formulations of larvicides continue to prove efficacious against larval *Ae. aegypti*. In particular, we found that temephos–plaster formulations, plus the emulsifier Atlox, provided greater mortality for a longer period of time against this species when compared with similar plaster formulations without an emulsifier.

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