AN EVALUATION OF TEMEPHOS IN WATER DRUMS IN TRINIDAD, W.I.[1,2]

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ABSTRACT: The residual effect of temephos sand granules (1%) was determined using water samples obtained from drums located at Chaguanas and D'Abadie, Trinidad, W.I. The weekly bioassay against *Aedes aegypti* larvae showed that at Chaguanas and at D'Abadie over 70% mortality was observed after 4 and 6 weeks respectively. Laboratory experiments showed that with the complete turnover of water in drums, there was sufficient active ingredient to provide 70% control up to 6 days. The reasons for this performance of temephos are discussed.

INTRODUCTION

In most parts of Latin America and the Caribbean the collection and storage of rainwater for household purposes is well known. Storage containers (e.g., drums, tubs, buckets and cisterns) have been found to be the major breeding foci of *Aedes aegypti* (Linn.) in Puerto Rico (Moore et al. 1978), Cayman Islands (Nathan and Giglioli 1982) Antigua (Giglioli 1979) and in certain parts of Trinidad (Chadee 1977[3]).

In 1976, the Insect Vector Control Division (IVCD), Ministry of Health and Environment, embarked on an *Ae. aegypti* eradication program utilizing 1% temephos sand granules for focal treatment at a dosage rate of 1 ppm. Temephos was employed as the choice insecticide because of its larvicidal qualities (Brooks et al. 1967) and also for toxicological reasons. Temephos is considered by WHO as an acceptable substance for potable water.

Preliminary experiments in the U.S. Virgin Islands (Brooks et al. 1965, 1966) showed this insecticide to be suitable for mosquito control in rural and urban areas (Bang and Tonn 1969a, 1969b, 1969c). However, during 1981, in Trinidad, questions about the residual efficacy of temephos during treatment cycles were raised, especially since no resistance to temephos has been detected (Chadee, unpublished data).

This study was done to determine the residual effect of 1% temephos in 208 liter (55 gallon) drums under both laboratory and field conditions.

MATERIALS AND METHODS

FIELD TRIALS. The field study was conducted from June–July, 1983 at Chaguanas and D'Abadie, Trinidad, W.I. At each location, five 208 liter (55 gallon) drums, each with one end removed, were filled with water. Four drums at each study area were treated with 20.8 gm of temephos sand granules. (1%) (0,0,0,0,- tetramethyl 0,0 - thiodi - P - phenylene phosphorothioale) while the fifth drum was left untreated as the control. The householder was informed to normally use and refill the drums. Water samples from each study area were collected from below the water surface on a weekly basis and transported to Insect Vector Control Division Laboratory for bioassay testing against 3rd instar *Ae. aegypti* larvae.

LABORATORY TRIALS. At the laboratory, experiments were conducted using three 208 liter drums with the same treatment regimen as administered in the field trials. That is, drums A and B were treated while drum C was used as the control. In the laboratory experiments all water was removed from drums and replaced on a daily basis. Prior to the emptying of drums, water samples from drums A, B and C were made from below the water surface. All water samples from the field and laboratory were tested using 25, 3rd instar *Aedes aegypti* larvae from a colony established at the IVCD laboratory. The larvae were placed into 250 ml of the water samples in waxed paper cups. After 24 hr exposure, larval mortality rates were determined. The acceptable level of mortality was 70% and above, below 70% mortality retreatment is recommended.

RESULTS AND DISCUSSIONS

As seen in Table 1, 1% temephos (1 ppm) sand granules produced acceptable results for 6 wk in D'Abadie and 4 wk in Chaguanas. At

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[1] Published with approval from the Ministry of Health and Environment, Trinidad and Tobago, W.I.

[2] Mention of a pesticide in this paper does not constitute a recommendation by Insect Vector Control Division of the Ministry of Health and Environment, Trinidad and Tobago, W.I. This paper reflects the results of research only.

[3] D. D. Chadee. 1977. Reasons for the high incidence of *Aedes aegypti* (Linn.) in Trinidad, W. I. Unpublished B.Sc. Honors Thesis, Dalhousie University. 48 pp.

Table 1. Mean weekly mortality rates (% ± S.D.) of *Aedes aegypti* obtained from drums at Chaguanas and D'Abadie, Trinidad, W.I. (1983).

Localities	Mean weekly mortality											
	1	2	3	4	5	6	7	8	9	10	11	12
Chaguanas	94.2±1.5	96.4±2.0	94.1±4.4	69.1±3.1	63.2±1.8	88.2±3.4	54.9±2.3	63.9±0.8	20.2±5.1	40.7±3.2	30.1±2.1	31.8±1.0
Control	0.0	0.0	3.4	2.7	0.0	0.0	0.0	0.0	0.0	4.0	0.7	0.0
D'Abadie	90.2±4.4	85.5±2.0	90.8±3.1	80.2±5.0	94.0±3.4	85.7±3.0	61.2±5.2	58.3±3.0	56.0±1.8	47.3±4.7	43.8±1.4	51.2±3.7
Control	0.0	0.0	3.4	2.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0

Chaguanas, during wk 4 and 5, heavy rains caused excessive overflowing of the experimental water drums and this was probably responsible for diluting the temephos concentration. However, on wk 6 when the heavy rains subsided, 88% mortality was observed (Table 1). It is quite possible that once the constant overflow of water in the drum ceased, the chemical was dispersed in the drum. Bang and Tonn (1969b) and Sutherland et al. (1974) found that temephos left the granules and was absorbed on the side of some containers, on bottom debris and on organic matter. This would therefore further reduce the quantity of active ingredient present in the water samples collected in the field.

The data obtained during the D'Abadie and Chaguanas field trials demonstrated that effective concentrations of temephos were obtained after approximately 5–6 wk under normal household usage. Brooks et al. (1966) found that 1 ppm application of temephos in water storage drums produced 13 wk or longer of effective coverage. In Trinidad however, water drums have been utilized as water holding containers and not as water storage utensils as is found in other Caribbean and Latin American countries.

Table 2 shows that over 70% mortality was observed up to 5 days after which mortality declined. Brooks et al. (1966) indicated that 50% of the granular temephos active ingredient was released within 48 hr when placed in water storage containers. From our data collected, similar results were obtained during the laboratory trials as 100% mortality rates were observed during days 1 and 2 (see Table 2). However, 100% mortality rates were not observed during the field trials (see Table 1).

Ninety-five percent of Trinidad has been covered by 8–10 wk abatement cycles (Insect Vector Control Division, 1982[4]). However, the results of the present study indicate that the 8–10 wk abatement cycle may not be suitable for areas served by truck-borne water because the 1% temephos would only be effective as a larvicide for 6 days, thus leaving the remaining 9-wk period with insufficient insecticide protection. That is, the temephos would probably be still active but it has been diluted below the acceptable point of effectivity (Table 2).

The dilution of temephos as found during this study would severely hamper any eradication or control program, for all programs depend on time, efficacy of work technique and on longevity of insecticide. As a result, it is

[4] Insect Vector Control Division, 1982 Annual Report, Ministry of Health and Environment, Trinidad and Tobago. Government Printery. 42 pp.

Table 2. Daily mortality rates (%) of *Aedes aegypti* obtained from treated drums at Insect Vector Control Division Laboratory, Trinidad, W.I.

	Days after treatment							
	1	2	3	4	5	6	7	8
A	100	100	93.7	90.3	83.1	53.2	32.9	20.0
B	100	100	98.2	85.2	80.9	60.9	40.7	30.1
Control	0.0	0.0	1.0	0.0	0.0	2.0	4.0	1.0

suggested that eradication programs should not adopt the same treatment regimens in all areas without first identifying certain environmental and socioeconomic circumstances, since unique areas would have to be identified and subsequently treated in more effective ways. For example, in areas with truck-borne water, the duration of the treatment cycle should be shortened to coincide with the dilution effect of the insecticide or insecticides.

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