An evaluation of Malathion ULV spraying against caged and natural populations of *Aedes aegypti* in Trinidad, West Indies

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Summary

Malathion ULV applied by Leco Fog Generators mounted on trucks in St. Joseph, Trinidad, W. I. in 1984 was ineffective against natural and caged populations of Aedes aegypti. *The number of eggs collected in St. Joseph and in the control area remained almost constant despite treatment (913/840). In addition, the mortality rates of the caged adults showed 55 % outdoors and 30 % indoors. Moreover, there was an increase in the adult landing count after treatment. Alternative treatment strategies are recommended.*

Key words : *Aedes aegypti* — Vectors — ULV — Control — Trinidad.

Résumé

ÉVALUATION D'UN TRAITEMENT ULV AU MALATHION CONTRE DES POPULATIONS NATURELLES LIBRES ET ENCAGÉES D'*AEDES AEGYPTI* À LA TRINITÉ, TRINIDAD ET TOBAGO. *L'application de malathion en ULV par des générateurs Leco montés sur des camions à St Joseph, la Trinité, s'est montrée sans effet contre des populations libres et encagées d'*Aedes aegypti. *Le nombre d'œufs recueillis à St Joseph et dans la zone de lutte est demeuré presque constant malgré le traitement. De surcroît les taux de mortalité des adultes en cages ont été de 55 % au-dehors et 30 % à l'intérieur. De plus, on a constaté une augmentation du nombre des adultes qui se posaient après le traitement. D'autres stratégies de traitement sont recommandées.*

Mots-clés : *Aedes aegypti* — Vecteurs — ULV — Contrôle — La Trinité.

Introduction

During 1977-78, a dengue type 1 epidemic occured in most parts of the Caribbean and Latin American region (P.A.H.O., 1979). The epidemic reached Trinidad in December 1977 and continued throughout 1978 (Hamilton, 1979 ; Tikasingh and Laurent, 1981). In addition, a jungle yellow fever outbreak occured in the latter part of 1979 and continued into August 1980 resulting in seven deaths (Chadee, 1984). Prior to these outbreaks, the Insect Vector Control Division of the Ministry of Health and Envi-

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ronment embarked on an *Aedes aegypti* Linn. eradication program in Trinidad. However, during these disease outbreaks, an intensive adulticiding program was initiated using both aerial and ground malathion ultra low volume (ULV) spraying operations but if evaluations were made, they were not documented.

Voluminous literature is available on the application and efficacy of both air and ground ULV applications against *Ae. aegypti* (Uribe *et al.*, 1984 ; Stains *et al.*, 1969 ; Fultz *et al.*, 1972 ; Axtell and Dukes, 1974 ; Fox, 1980). In addition, within recent years, the impact of ground ULV application on *Culex* populations has been measured for urban pest control programs (Strickman 1979, Leiser *et al.*, 1982).

The purpose of this study was to determine the effects of ground ULV application on natural *Ae. aegypti* populations, on caged adults and on ovipositing adults.

Materials and method

The *Ae. aegypti* mosquito populations in two similar localities in Trinidad, W. I., were monitored over a 14 week period. During this study, St. Joseph received four applications of ground malathion ULV while the other area, Montrose, served as the untreated control.

St. Joseph was treated by the truck mounted Leco model dispersing 95 % malathion insecticide at a rate of 130 ml/mn. This is the manufacturer's recommended standard application rate. Treatment began at 5 pm and was applied while driving the ULV dispenser at 10 mph (16.1 kph). Droplet size along the pre-established route averaged 16 microns. Approximately one hour was required to treat the St. Joseph area. In addition, the weather conditions were within the manufacturer's recommendation for the ULV application of malathion.

The measure more precisely the effect of ULV malathion on adult mosquitoes, 25 adult *Ae. aegypti* in screen mesh cages were placed at outdoor and indoor locations one hour before each treatment cycle. A total of ten cages was used, four indoors and four outdoors, while two cages were used as the control. Glucose soaked cotton was added to each cage, as a source of moisture and nutrition. All cages were collected at 7 am on the morning after each treatment and the percent mortality was determined.

The adult population of gravid *Ae. aegypti* mosquitoes was evaluated using the conventional ovitraps (Fay and Eliason 1966). The ovitraps were located at the same sites as the caged adults and positioned according to the criterion established by Evans and Bevier (1969). Using this method both the pre-and post-treatment *Ae. aegypti* populations were determined.

In addition, human bait captures for *Ae. aegypti* were done one hour before and one hour after treatment for four days of treatment. This was done to determine the effect of ground ULV spraying on the natural *Ae. aegypti* mosquitoes.

Results

The total number of *Ae. aegypti* eggs collected from the treated and control areas did not differ significantly, 1220/1144, indicating that the two areas contained comparable mosquito populations. Fig. 1 shows the total number of *Ae. aegypti* eggs oviposited before and after ULV malathion treatment in St. Joseph and the untreated Montrose area (control). The ULV malathion ground spraying produced no significant decline in the *Ae. aegypti* egg population after the four treatment cycles on weeks 8-11. In fact, the number of eggs collected in St. Joseph and in the Montrose control remained almost constant despite this treatment (913/840).

TABLE I

The number of *Aedes aegypti* mosquitoes landing on human-bait for a period of one hour before treatment (Day 0) and each of four days after treatment with malathion ULV fogging in St. Joseph, Trinidad, W. I., 1984 (NC = no collection due to rain).

TREATMENT	DAYS AFTER TREATMENT				
	0	1	2	3	4
1	5	8	8	16	11
2	4	9	8	13	8
3	4	2	NC	9	7
4	3	16	16	18	18
TOTAL	16	35	32	56	44
AVE.	4.0	8.7	10.6	14.0	11.0

Table I shows the *Ae. aegypti* natural population attracted to human bait during pre- and post-ULV ground malathion application in St. Joseph. These adult collections indicated that on one day after treat-

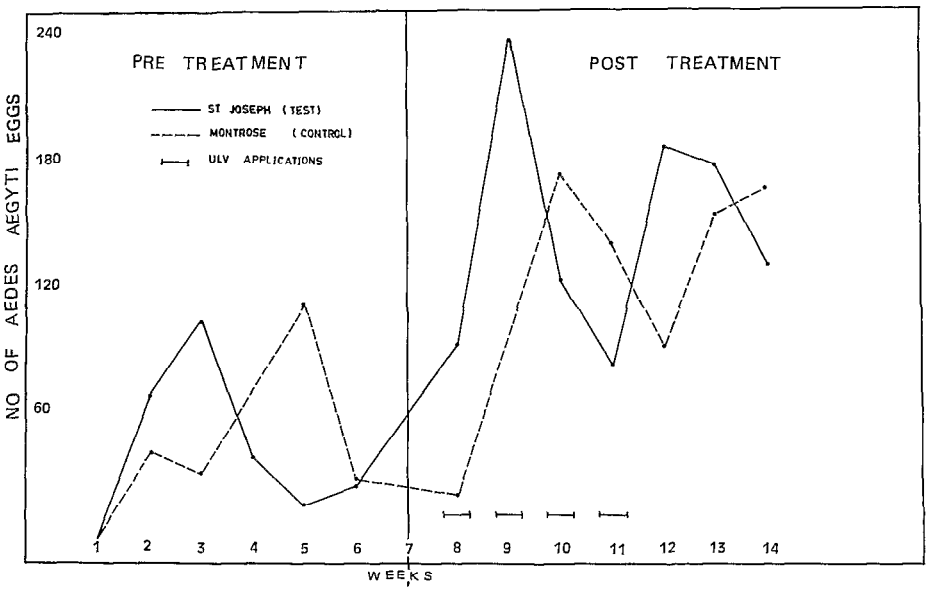

FIG. 1. — The total number of *Aedes aegypti* eggs deposited in ovitraps in a treated and control area of Trinidad, W. I., 1984.

ment (except No. 3), the landing counts increased thus indicating a greater landing count on days after treatment than before. The average of the five landing counts exceeded the pre-treatment counts on days 1 to 4.

In addition, the mortality rates of the caged adults located indoors and outdoors during the ULV malathion ground applications in St. Joseph showed 55 % mortality for outdoor caged adults and 30 % mortality for the indoor caged adults (table II). The mean mortality rates of the indoor caged adults indicate that the malathion insecticide did not effectively penetrate the houses using the ULV dispenser.

TABLE II

Mean mortality rates (% ± S.D) of indoor and outdoor caged *Aedes aegypti* after ULV malathion application in St. Joseph, Trinidad, W. I., 1984.

INDOOR CAGES % Dead	OUTDOOR CAGES % Dead	CONTROL % Dead
30 ± 1.5	55 ± 2.8	15 ± 0.7

Discussion

The results of this study indicate that the dispensing of malathion from truck mounted generators was not effective against the indigenous *Ae. aegypti* population, as there were no decline in the adult *Ae. aegypti* mosquito populations in the St. Joseph area after four weeks of this treatment. Moreover, there was an increase in the number of adults and eggs collected during the post-spray period as compared with the pre-spray period. The results indicate that a flourishing adult population existed with many females obtaining blood meals and ovipositing. Fox (1980) found a similar pattern of increased activity in the adult populations after ground and aerial ULV treatment in Puerto Rico.

In St. Joseph, the mean mortality rates of the caged adults did not exceed 42 % and was less than 15 % in the control cages. In addition, the mortality rates were significantly higher in the traps located outdoors than those placed indoors. Leiser *et al.* (1982) however, found low mortality rates in *Culex* caged adults located in vegetation along alleys as compared with cages set 10 metres from the street. It should be noted that all streets in the St. Joseph study area were treated in accordance with the manufacturer's recommendation. Therefore the low mor-

tality rate of the caged adults indicates that the ULV spray may not adequately have penetrated the houses in the treatment area.

The results obtained by Fox (1980), Leiser *et al.* (1982) and the present study seem to indicate that adulticiding with truck mounted ULV is ineffective. However, it is quite possible that ground ULV spraying may be an unsuitable innovation for conditions in Trinidad and possibly in Puerto Rico. For example, one major constraint to the ULV program was the problem of houses surrounded by fences. It was observed that streets with houses fenced with concrete blocks, the ULV spray did not adequately penetrate the houses because the spray was blocked by this solid barrier. In addition, when adjustments to the nozzle were made, the insecticide was emitted above the house eaves and roofs. It is suggested that in areas with this type of man made physical barrier, the ULV backpack model should be utilized as a suitable alternative.

The results of this study seem to suggest the need for more intensive source reduction campaigns and efficient treatment procedures. Uribe *et al.* (1984) found aerial spraying suitable for *Ae. aegypti* in both outdoor and indoor locations in Colombia. In contrast, this procedure was found ineffective in both Puerto Rico and Trinidad indicating that containment programs should adopt strategies suitable to local conditions.

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