FIELD EVALUATION OF ULTRA-LOW VOLUME APPLICATIONS WITH A MIXTURE OF d-ALLETHRIN AND d-PHENOTHRIN FOR CONTROL OF *ANOPHELES ALBIMANUS* IN HAITI

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ABSTRACT. Ultra-low volume applications of d-allethrin and d-phenothrin could possibly reduce populations of *Anopheles albimanus* when used in conjunction with residual spraying of fenitrothion. The experiments were carried out in Les Cayes, Haiti.

Hobbs (1976) noted that weekly ULV spraying of synergized pyrethrins reduced natural populations of *Anopheles albimanus* Wied. during a heavy malaria transmission season in El Salvador. Itoh et al. (1988) reported that weekly ULV applications of an emulsifiable concentrate formulation containing d-allethrin and d-phenothrin, in conjunction with larvicidings with fenitrothion, reduced the density of *Anopheles* mosquitoes in Dar es Salaam, Tanzania.

Since reducing anophelism is important to malaria control, the present study employed weekly ULV applications with a mixture of d-allethrin and d-phenothrin carried out for 2 periods in 1987 at Les Cayes in Haiti. The impact of ULV applications on the density of mosquitoes is discussed.

The Les Cayes experimental area (ca. 100 ha), situated in the southwestern part of Haiti, includes about 25,700 inhabitants and 7,000 houses. The rainy season occurs twice a year from April to June and September to November. *Anopheles albimanus*, the principal vector, breeds mainly in adjacent rice paddies.

The ULV applications consisted of a 20% emulsifiable concentrate of d-allethrin and d-phenothrin at a rate of 6:14 (w/w) (Pesguard PS 201, Sumitomo Chemical Co. Ltd.). One liter of Pesguard PS 201 was diluted with 4 liters of gas oil (kerosene).

The diluted solution was sprayed between 1800 and 2100 h at one week intervals by a Leco HD sprayer mounted on a pick-up truck, at a discharge rate of 580 cc/min, with a vehicle speed of approximately 6 km/h. Each application was started on the down-wind side of the spray area. The dosage of Pesguard PS 201 was calculated to be 216 ml/ha (Itoh et al. 1988). The first cycle of 7 weekly sprayings was from March 18 to May 21, inclusive. The second cycle of 5 weekly sprayings was from August 27 to September 24 and October 15.

Direct-hit efficacy of Pesguard PS 201 was determined on 2 occasions (August 27 and September 10) by exposing 15 female *An. albimanus*, collected on the previous day, in cylindrical cages (80 mm diam × 150 mm height) made of 1.5 mm mesh nylon netting. The cages were randomly suspended indoors and outdoors of 2 or 3 houses. Knockdown was observed 30 min after spraying. Specimens were then transferred to a paper cup provided with cotton soaked sugar solution and held for a 24 h count. Adult mosquito densities were assessed by 2 different methods: human-bait collections and indoor resting collections in 2 selected houses (one in the center of the area and another at the border). For the human bait collections, two volunteers collected mosquitoes landing on them. Collections were made from 1900 to 1945 h. Remaining mosquitoes resting in the house were collected by aspiration for a 15 min period.

The ULV applications of Pesguard PS 201 resulted in almost 100% knockdown in 30 min, and 100% mortality against caged female *An. albimanus*. The population density was low during the first round of spraying (Table 1), and it is difficult to tell whether the density was kept low by the ULV spraying. In the second round, the number of collected mosquitoes decreased from 12 to 0 in the resting collections and from 18 to 6 in the human landing collection, 4 days after the first spraying (August 27). During the weekly sprayings (September 7–28), the number of captured *An. albimanus* remained at 0 in the resting collections and 0 to 2 in the human landing collections. The low level was continued until 13 days after the last spraying (October 28), and the density gradually increased after that date.

Breeland (1972) reported that *An. albimanus*, in coastal El Salvador, had a relatively short activity period, during early evening hours, beginning after sunset. The spraying time (1800–2100 h) in this experiment coincided with the most active period reported for this species. Correct timing of this ULV spraying probably contributed to reduction of the targeted *An. albi-*

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Table 1. Influence of ULV applications of d-allethrin and d-phenothrin on population density of *Anopheles albimanus* in Les Cayes, Haiti.

Spraying date	Collecting date	Days after previous treatment	No. of mosquitoes	
			Resting[1]	Man landing[2]
—	Mar. 12	—	3	6
Apr. 2	Apr. 8	6	0	4
9	13	4	0	2
15	20	5	0	0
23	27	4	0	0
29	May. 5	6	0	4
May. 7	11	4	0	0
13	19	6	0	0
21	Aug. 24	90	12	18
Aug. 27	31	4	0	6
Sep. 3	Sep. 7	4	0	0
10	15	5	0	2
17	21	4	0	0
24	28	4	0	1
Oct. 15	Oct. 19	4	1	3
	28	13	6	8
	Nov. 5	21	13	15
	24	40	19	26
	Dec. 7	54	21	30

[1] Indoor resting collection.
[2] Human landing collection.

manus population. Two rounds of interdomiciliary residual spraying with fenitrothion were carried out in the rural zone around the experimental area, from March to May and from August to September 1986, but there was no residual spraying in 1987. There was no mosquito control except for the 1987 ULV application in the experimental area. The low density of *An. albimanus* seems to be due to the effect of the residual sprays with fenitrothion in the previous year. Ultra-low volume applications should be considered supplementary to residual spraying, because of the quick recovery of mosquito density after interrupting ULV spraying.

Residual spraying for malaria control in an urban area, such as Les Cayes, is difficult due to the high refusal rate. Under such circumstances, ULV application offers an additional method of malaria control. The present experiment revealed that ULV application of *d*-allethrin and *d*-phenothrin could possibly reduce populations of *An. albimanus* when used in combination with residual spraying of fenitrothion.

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