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FIELD EVALUATION OF ALPHACYPERMETHRIN AND LAMBDA-CYHALOTHRIN AGAINST *AEDES AEGYPTI* AND *AEDES ALBOPICTUS* IN MALAYSIA

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ABSTRACT. Alphacypermethrin (Fendona®) and lambda-cyhalothrin (Icon®) were evaluated against sentinel bloodfed adults and 4th-instar larvae of *Aedes aegypti* in a housing estate in Malaysia. The impact of both pyrethroids on field populations of *Ae. aegypti* and *Aedes albopictus* were monitored weekly using oviposition trap samples. Both alphacypermethrin and lambda-cyhalothrin showed adulticidal and larvicidal effects.

INTRODUCTION

In Southeast Asia, *Aedes albopictus* (Skuse) has been incriminated as a secondary vector of dengue fever and *Aedes aegypti* (Linn.) as the principal vector of dengue viruses (Russell et al. 1969, Chan et al. 1971, Jumali et al. 1979, Harinasuta 1984). The dengue viruses may produce occasional fatal cases, usually among children (Rudnick and Chan 1965, Harinasuta 1984).

Gratz (1991) stated that properly applied and timed ultra-low volume (ULV) insecticide application could be effective in suppressing dengue vectors at the time of epidemics. However, he cautioned against the use of ULV insecticide spraying as a routine mosquito control measure as an alternative to environmental measures.

Lambda-cyhalothrin had been shown to be effective against dengue vectors under laboratory and field conditions in Malaysia (Lim and Visalingam 1990; Lim and Lee 1991; Sulaiman et al. 1991, 1993). However, alphacypermethrin has yet to be evaluated in the field in Malaysia against dengue vectors. Thus, the objective of this study was to compare the efficacy of lambda-cyhalothrin (Icon®) and alphacypermethrin (Fendona®) in the field at a housing estate in Kuala Lumpur, Malaysia.

MATERIALS AND METHODS

A housing estate in Bandar Tun Razak, approximately 10 km from the center of Kuala Lumpur, was chosen for this study. The housing estate is composed of single-story, brick-walled connected houses. The houses were divided into 3 sectors with 10 houses chosen at random from each sector. One sector was assigned to receive one pyrethroid spray application, a 2nd sector the other pyrethroid, with the 3rd sector sprayed with water only, which served as the control. Suspension concentrate (SC) formulations of alphacypermethrin (Fendona; Shell Public Health, UK) and emulsion concentrate (EC) of lambda-cyhalothrin (Icon; I.C.I., UK) were diluted with water and applied as a thermal fog at a rate of 0.01 g AI/m^2 and at a volume of 2 liters/1,430 m^2. Each pyrethroid was sprayed 4 times over a 5–6 wk interval at 0900 h each time. Mortality and knockdown (immobile but not necessarily dead) of caged, 4-day-old bloodfed *Ae. aegypti* (fed 16 h prior to spray) were used to evaluate the efficacy of the 2 pyrethroids. Cylindrical screened sentinel cages (26 cm long × 18 cm diam) each contained 25 bloodfed female *Ae. aegypti.* Cages were hung inside a room in each house and outside each house at 1.5 m above the floor. A sugar cube was placed on top of each cage for *ad lib* feeding.

In addition, bottle containers (5.7 × 6.5 cm), each containing 25 4th-instar *Ae. aegypti* larvae in water, were placed on the floor against the wall inside and outside each house. Both the screened cages and the bottle containers were left at their placement sites 24 h after spray application.

The knockdown of mosquito adults and larvae was recorded 1 h after spraying and mortalities were recorded 24 h postspraying. The average temperature inside houses was 28 ± 2°C and RH was 75 ± 5%.

In order to monitor field populations of *Ae. aegypti* and *Ae. albopictus,* bottles containing water and a paddle were placed inside each house in every sector about 13 wk before spraying. Each week, paddles were removed, replaced, and oviposited eggs were counted. Any larvae in bottle containers were also removed weekly, the species of mosquitoes determined, and the eggs pooled together as *Aedes* eggs. Data analysis used the least significant difference test (Choi 1978).

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Table 1. Knockdown and mortality effects of alphacypermethrin and lambda-cyhalothrin against sentinel *Aedes aegypti* adults and larvae.

	Adults				Larvae			
	Mean 1-h knockdown (%)		Mean 24-h mortality (%)		Mean 1-h knockdown (%)		Mean 24-h mortality (%)	
Treatment	Outside house	Inside house	Outside house	Inside house	Outside house	Inside house	Outside house	Inside house
Alphacypermethrin	99a[1]	99.8a	99.6a	100a	95.4a	92.4a	99a	98a
Lambda-cyhalothrin	100a	100a	99.8a	100a	97.4a	96.8a	97.2a	98a
Control	4.2b	4.4b	12.2b	10.2b	8.2b	7b	9.8b	8b

[1] Means within a column followed by the same letter are not significantly different ($P < 0.5$; least significant difference [Choi 1978]).

RESULTS AND DISCUSSION

There was no significant difference between alphacypermethrin and lambda-cyhalothrin in larval knockdown or larval mortality ($P > 0.05$) (Table 1), but both pyrethroids were significantly different from the control ($P < 0.001$) (Table 1). Similarly, there was no significant difference for knockdown or mortality of adults ($P > 0.05$) between the 2 pyrethroids, but both pyrethroids were significantly different from the control ($P < 0.001$) (Table 1). These results indicate that both alphacypermethrin and lambda-cyhalothrin have larvicidal and adulticidal effects.

Figure 1 shows the population of *Ae. aegypti* larvae in field containers before and after spraying with pyrethroids. A reduction of *Ae. aegypti* larval populations to zero was observed 5 times after spraying with alphacypermethrin, on weeks

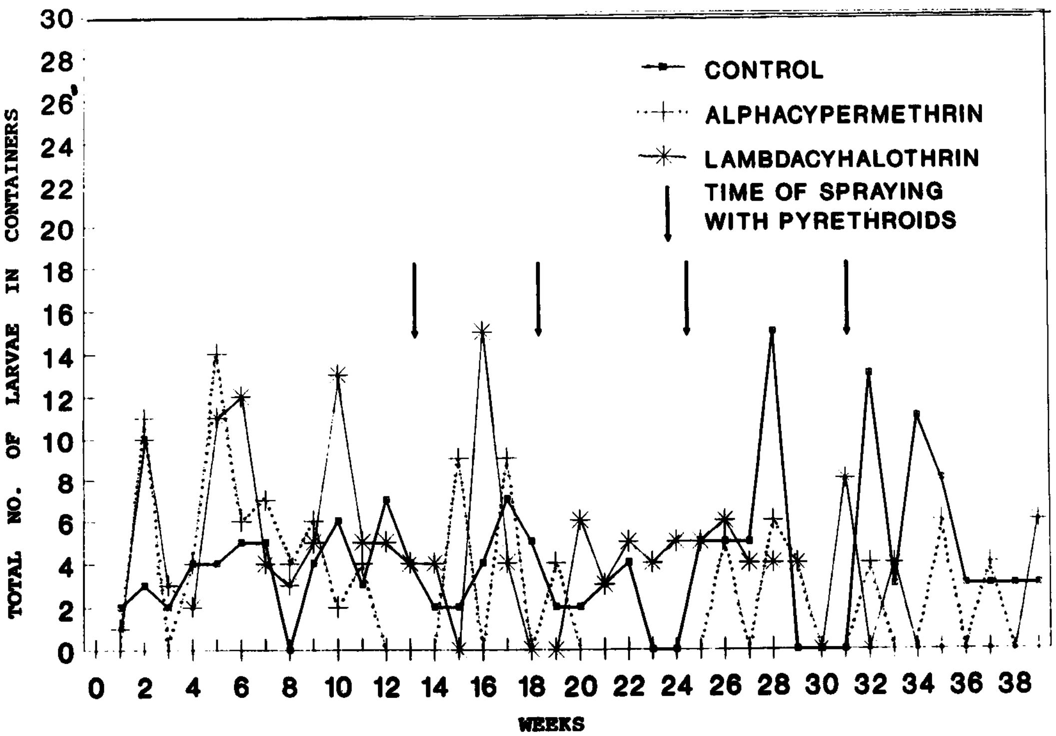

Fig. 1. Field populations of *Aedes aegypti* larvae before and after spraying with alphacypermethrin and lambda-cyhalothrin at 0.01 g AI/m^2.

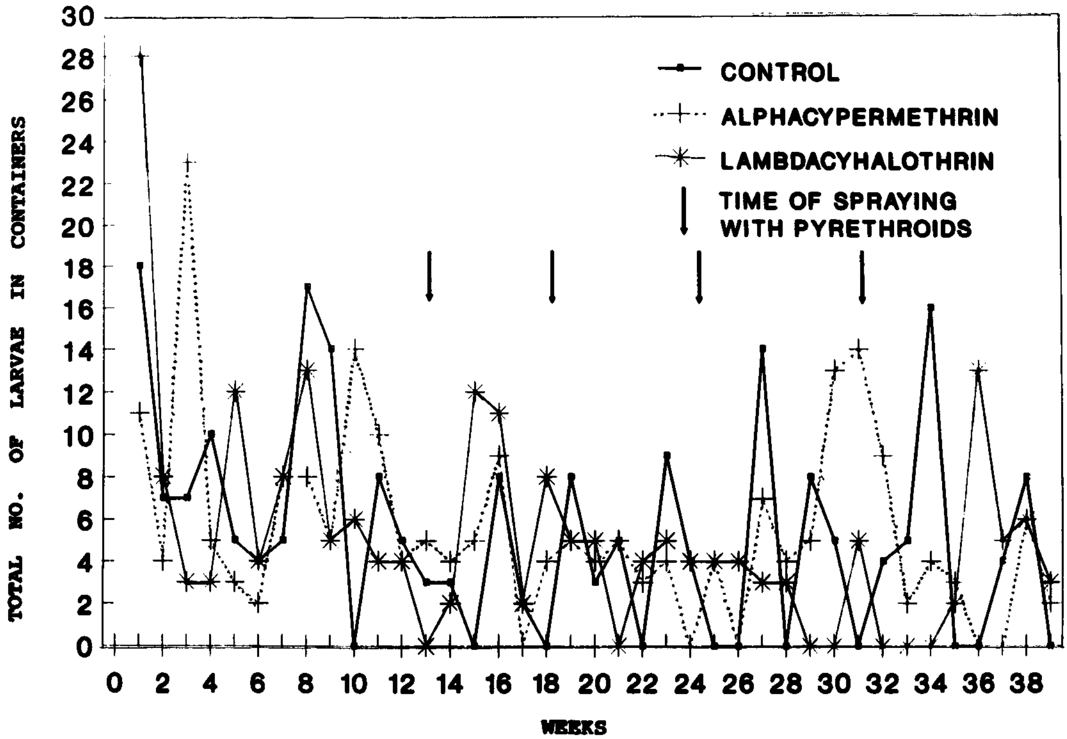

Fig. 2. Field populations of *Aedes albopictus* larvae before and after spraying with alphacypermethrin and lambda-cyhalothrin at 0.01 g AI/m^2.

16, 18, 20–25, 27, and 30–31; 4 times after spraying with lambda-cyhalothrin, on weeks 15, 18–19, 30, and 32; and on weeks 23–24 and 29–31 after spraying for the control. A variable population of *Ae. aegypti* larvae occurred in the study area; however, the observed trend of possible spray effects was the general suppression of *Ae. aegypti* larval populations after spraying with both pyrethroids.

A reduction of *Ae. albopictus* larval populations to zero was observed for 10 wk in the control sector during the 4 sprayings, compared to 4 wk with alphacypermethrin, and 7 wk with lambda-cyhalothrin (Fig. 2). Again, the population variation was high at the control site. However, the peak larval population between the 4 sprayings for the control sector was generally higher than the peak larval population of *Ae. albopictus* in sectors sprayed with alphacypermethrin and lambda-cyhalothrin. This showed that both pyrethroids had an effect on the *Ae. albopictus* larval population predominantly breeding outside houses. Between 99 and 100% of mosquito breeding outside houses in the study area was by *Ae. albopictus.*

Both alphacypermethrin and lambda-cyhalothrin had an impact on the *Aedes* adult population as measured by oviposition trapping (Fig. 3). Oviposition was reduced to zero on weeks 17 and 34 in the housing sector sprayed with alphacypermethrin, and on weeks 21–22, 29, 32, and 35 in the sector sprayed with lambda-cyhalothrin, whereas oviposition occurred throughout the spraying period in the control sector. During the 39-wk study period, a total of 998 eggs were collected in ovitraps in the control sector, 765 eggs in the housing sector sprayed with lambda-cyhalothrin, and 692 eggs in the housing sector sprayed with alphacypermethrin. Thus, both alphacypermethrin and lambda-cyhalothrin showed effects in suppressing field populations of *Ae. aegypti* and *Ae. albopictus.*

Sulaiman et al. (1993), in similar studies, also reported lambda-cyhalothrin as an effective adulticide with additional larvicidal effects. According to Lim and Visalingam (1990) lambda-cyhalothrin as a thermal fog showed an average of 2.5 times more knockdown activity and 5 times more adulticidal activity than cypermethrin against *Ae. aegypti* and they concluded that the compound could be used against *Ae. aegypti* at a concentration as low as 2 g AI/ha. Lim and Lee (1991), using lambda-cyhalothrin applied as a cold ULV aerosol, showed an average of 1.7 times more knockdown activity and 3.2 times more adulticidal activity against *Ae. aegypti* compared

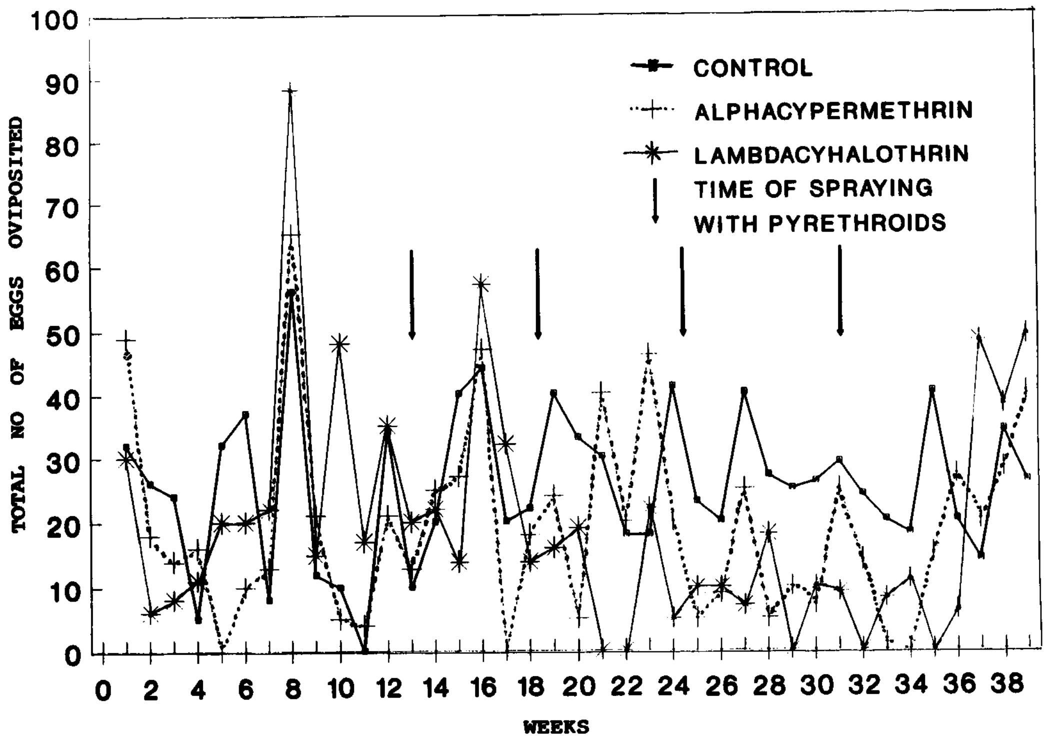

Fig. 3. Field populations of *Aedes* eggs (*Aedes aegypti* and *Aedes albopictus*) oviposited before and after spraying with alphacypermethrin and lambda-cyhalothrin at 0.01 g AI/m^2.

to cypermethrin. Our results indicate that Fendona (alphacypermethrin) is another new-generation pyrethroid that potentially can be used for controlling dengue and dengue hemorrhagic fever vectors.

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