

EVALUATION OF PYRETHROIDS LAMBDA-CYHALOTHRIN, DELTAMETHRIN AND PERMETHRIN AGAINST *Aedes albopictus* IN THE LABORATORY

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ABSTRACT. Three pyrethroids were evaluated in the laboratory against *Aedes albopictus* females by exposure to insecticide impregnated papers, and to 4th instar *Ae. albopictus* larvae as insecticide solutions. Lambda-cyhalothrin was found to be the most effective pyrethroid when tested against *Aedes albopictus* adult females and larvae compared with that of deltamethrin and permethrin.

Aedes albopictus (Skuse) has been incriminated as the vector of dengue fever in epidemics in Malaysia and other Southeast Asian countries (Russell et al. 1969, Chan et al. 1971, Jumali et al. 1979). Efforts directed toward controlling *Aedes* larvae in and near houses in Southeast Asia have had little effect on population density of adult *Aedes albopictus* (Gould et al. 1971, Hii 1979). In an epidemic situation, spraying with insecticides is still essential to stop the transmission besides source reduction methods. The objective of this study was to evaluate the efficacy of 3 new pyrethroids on *Aedes albopictus* in the laboratory.

The pyrethroids used were PP 321 2.5EC containing lambda-cyhalothrin 2.5% weight/volume, discovered and patented by ICI Agrochemicals, UK; Cislin® 2.5% EC containing deltamethrin 2.5% weight/volume, bought from Wellcome (Malaysia) Pte. Ltd.; and Perigen® EC containing permethrin 10% weight/volume, bought from Wellcome (Malaysia) Pte. Ltd.

The mosquito *Aedes albopictus* used was a Gombak strain (F-130). This species has been maintained in the insectarium since 1985 and was not exposed to any insecticide or biological control agents. *Aedes albopictus* females were exposed for 1 h to filter paper (15 × 16 cm) impregnated with varying concentrations in the range of 5.6×10^{-4} to 55.56 mg/m² of the above pyrethroids. Twenty-five 2- to 5-day-old female mosquitoes were exposed to the above filter papers in a W.H.O. test kit, then transferred to holding cups. Sugar water impregnated into cotton was provided as food.

Twenty-five *Aedes albopictus* 4th instar larvae were exposed in each of 600-ml glass beakers containing 250 ml of prepared pyrethroid concentrations ranging between 1×10^{-23} to 1×10^{-7} % active ingredient. The control was replicated twice.

All the above experiments were conducted in the laboratory at a temperature of $25 \pm 1^\circ\text{C}$ and $80 \pm 5\%$ RH. Mortality was recorded after 24 h.

Four replications, by day, were conducted. Determination of the LC₅₀ and LC₉₀ levels, regression slopes and associated 95% fiducial limits were determined with an IBM-compatible personal computer using probit analysis (Finney 1962). Comparative dose for adults and response values of the 3 pyrethroids tested against *Aedes albopictus* females are shown in Table 1. *Aedes albopictus* females were more susceptible to lambda-cyhalothrin than deltamethrin or permethrin. The lambda-cyhalothrin LC₅₀ and LC₉₀ were 0.15 and 12.78 mg/m², respectively. The LC₅₀ for deltamethrin was higher than LC₅₀ of permethrin (8.69 mg/m²:5.50 mg/m²). However, at 90% mortality, the LC₉₀ for permethrin was higher than LC₉₀ of deltamethrin (183.55 mg/m² and 65.93 mg/m²). The regression slope of permethrin indicates that a slight increase in deltamethrin concentration will cause a higher mortality of *Ae. albopictus* adults compared with that of permethrin (Table 1). Thus the relative efficacy in decreasing order was lambda-cyhalothrin, deltamethrin and permethrin.

Comparative doses for larvae-response values of the 3 pyrethroids tested against *Ae. albopictus* 4th instar larvae are shown in Table 1. As in the previous experiment, lambda-cyhalothrin was the most effective compared with deltamethrin and permethrin. *Aedes albopictus* larvae were most susceptible to lambda-cyhalothrin (LC₉₉ = $1.53 \times 10^{-7}\%$ AI) compared with deltamethrin (LC₉₉ = $6.46 \times 10^{-1}\%$ AI) and permethrin (LC₉₉ = $5.25 \times 10^{-4}\%$ AI). Studies by Takahashi et al. (1985) in Japan indicated that *Aedes albopictus* larvae had a LC₅₀ value for permethrin between 0.0023 to 0.045 ppm, which was higher than the present study with LC₅₀ value of $2 \times 10^{-10}\%$ AI (equivalent to 0.000002 ppm). Thus the Malaysian *Aedes albopictus* Gombak strain was more susceptible than that of the Japanese strain.

In summary, lambda-cyhalothrin was shown to be more effective than deltamethrin and permethrin when compared against *Aedes albopictus* in the laboratory.

Table 1. Mortality response of pyrethroids to *Aedes albopictus* adult females and 4th instar larvae in the laboratory.

Pyrethroid	Adults			Larvae		
	LC ₅₀ (95% CI) ¹	LC ₉₀ (95% CI) ¹	Slope ± SE	LC ₅₀ (95% CI) ²	LC ₉₀ (95% CI) ²	Slope ± SE
Lambda-cyhalothrin	0.15 (0.029-0.75)	12.78 (0.56-351.36)	0.66 ± 0.12	0.00 × 10 ⁻⁵ (0.00 × 10 ⁻⁵)	0.00 × 10 ⁻⁵ (0.00 × 10 ⁻⁵)	0.19 ± 0.03
Deltamethrin	8.69 (0.00-∞)	65.93 (0.00-∞)	1.46 ± 17.28	0.00 × 10 ⁻⁵ (0.00 × 10 ⁻⁵)	2.18 × 10 ⁻⁶ (2.03 × 10 ⁻⁸)	0.19 ± 0.04
Permethrin	5.50 (0.57-53.49)	183.55 (2.37-14,911.36)	0.84 ± 0.24	0.00 × 10 ⁻⁵ (∞ × 10 ⁻⁵)	1.79 × 10 ⁻¹ (4.52 × 10 ⁻⁸)	0.35 ± 0.06

¹ Units are in mg/m².

² Units are in % active ingredient.

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