Evaluation of lambdacyhalothrin, deltamethrin and permethrin against filth flies (Diptera: Muscidae, Calliphoridae) at a garbage dumping ground and a poultry farm in Malaysia

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Abstract: The pyrethroids lambdacyhalothrin, deltamethrin and permethrin were evaluated against field populations of housefly *Musca domestica* L. and blowfly *Chrysomya megacephala* (Fabricius) in a garbage dumping ground and a poultry farm. Lambdacyhalothrin and deltamethrin were more effective compared to permethrin during evaluation at a garbage dumping ground, causing high percentage of fly larval knockdown at 1 hr and larval mortality 24 hr after spraying. Applications at a poultry farm showed that all three pyrethroids were equally effective against fly larvae, 1 hr after spraying and lambdacyhalothrin was the most effective insecticide 24 hr after spraying.

INTRODUCTION

The potentials of housefly *Musca domestica* L. and blowfly *Chrysomya megacephala* (Fabricius) in transmitting pathogenic organisms such as protozoan cysts, helminth eggs and larvae, bacteriae and enteroviruses to food which would later be consumed by man are well documented (Reid, 1953; Greenberg, 1973; Sulaiman *et al.*, 1988a, b, 1989). Both fly species are among the major pests of public health importance in Malaysia and South-East Asian countries and control of these species depends largely on utilization of insecticides.

The objective of this study is to evaluate the pyrethroids lambdacyhalothrin (Icon), deltamethrin (Cislin) and permethrin (Perigen) against fly populations in the field in

Malaysia. The insecticides were tested against a mixed populations of *M. domestica* and *C. megacephala* at a garbage dumping ground and a poultry farm.

MATERIALS AND METHODS

Insecticides evaluation against housefly and blowfly at a garbage dumping ground in Lukut, Port Dickson. The garbage dumping ground is located at Lukut, Port Dickson, about 115 km to the south of Kuala Lumpur. It had an area of 2 ha. Rubbish originating from households, hotels and shops was trucked and dumped in this area daily. Four plots where flies were breeding in abundance were selected for this experiment. Each plot had an area of 10×10 m. Three plots were individually sprayed with a specific insecticide using a hand-operated knapsack sprayer

(CP15—manufactured by Cooper, Pegler & Co. Ltd., Sussex, England) and the fourth plot as a control was sprayed with an equal amount of water. Three insecticides, namely, Icon® EC containing lambdacyhalothrin 2.5% w/v, Cislin® EC containing deltamethrin 2.5% w/v and Perigen® containing permethrin 10% w/v were evaluated against both fly species at a dose of 0.01 g active ingredient/m² (=a total of 1 g active ingredient in 5 l of water for each insecticide). The plot for a specific insecticide was selected at random and the field experiment was repeated four times.

Larval sampling: Larval sampling was conducted using a wooden square with an inside opening of 30.48×30.48 cm. Ten samples each were taken from every plot randomly before spraying, and at 1 and 24 hr after spraying and the numbers of dead and live larvae were noted. The populations of both *M. domestica* and *C. megacephala* larvae during each sampling were pooled together.

Adult sampling: Adult sampling was carried out on each plot using the Scudder grill which is a series of 2.5 cm wooden slabs fixed 2.5 cm apart on a wooden frame to make a 45 cm square grill. The duration for each sampling was standardized at 1 min and the number of adult flies resting was counted. Ten samples each were taken randomly from every plot before spraying and at 1 and 24 hr after spraying. As in the case of the larvae, the numbers recorded for both species of adult flies were pooled together for each sampling. The data was analyzed by ANOVA and Least Significant Difference test (Choi, 1978).

Evaluation of insecticides against housefly and blowfly at Ceras poultry farm. The chicken farm was located about 18 km from Kuala Lumpur and the chickens were raised in rows of wire cages about 1 m above the ground. The droppings were usually removed from the concrete floor once every 2 weeks.

Four plots, each measuring 8×12.5 m, were chosen from one of the rows of chicken cages. Selection of the specific insecticide to be sprayed to each plot was made at random. Larval and adult samplings of the flies were conducted according to the method in experiment I. Analysis of variance was performed using the ANOVA and LSD test

(Choi, 1978).

RESULTS AND DISCUSSION

Field evaluation of the three pyrethroids on mortality of fly larvae in a garbage dumping ground at Lukut, Port Dickson, after 1 hr spraying showed that deltamethrin, lambdacyhalothrin and permethrin had caused a mean knockdown of 42.2, 27.6 and 10.7%, respectively, compared to 2.1% knockdown in the control plot (Table 1a). Thus, deltamethrin was more effective than permethrin (LSD, $p<0.01$) but not significantly different from lambdacyhalothrin at 1 hr after spraying (Table 1a). However, at 24 hr after spraying lambdacyhalothrin was the most effective insecticide causing 51.0% larval mortality compared to deltamethrin, permethrin and control with 41.7, 22.7 and 5.2% larval mortality, respectively. Thus, lambdacyhalothrin was more effective than permethrin (LSD, $p<0.01$) and control (LSD, $p<0.0005$) but not significantly different from deltamethrin (LSD, $p>0.05$) (Table 1b).

On field evaluation of the three pyrethroids against fly larvae at the Ceras poultry

Table 1a The knockdown of fly larvae, 1 hr after spraying at Port Dickson garbage dumping ground.

Insecticide	% knockdown of fly larvae	Mean (%)
Lambdacyhalothrin	20.3, 12.1, 15.5, 62.5	27.6
Deltamethrin	22.6, 65.9, 31.5, 48.8	42.2
Permethrin	11.2, 9.8, 15.9, 5.9	10.7
Control	0.0, 0.2, 0.0, 8.3	2.1

There is significant difference among the means (ANOVA, $p<0.05$). There is significant difference between deltamethrin and permethrin (LSD, $p<0.01$), but no significant difference between deltamethrin and lambdacyhalothrin (LSD, $p>0.05$).

Table 1b The mortality of fly larvae, 24 hr after spraying at Port Dickson garbage dumping ground.

Insecticide	% mortality of fly larvae	Mean (%)
Lambdacyhalothrin	74.8, 30.2, 38.3, 60.5	51.0
Deltamethrin	40.0, 33.4, 40.5, 52.7	41.7
Permethrin	8.6, 16.5, 28.4, 37.2	22.7
Control	0.7, 1.5, 0.0, 18.4	5.2

There is significant difference among the means (ANOVA, $p < 0.05$). There is significant difference between lambdacyhalothrin and permethrin (LSD, $p < 0.01$), but no significant difference between lambdacyhalothrin and deltamethrin (LSD, $p > 0.05$).

farm, 1 hr after spraying, lambdacyhalothrin, deltamethrin and permethrin resulted in 53.5, 58.3 and 50% mean knockdown, respectively, compared to that of control with 6.8% mean mortality of larvae (Table 2a). Lambdacyhalothrin and deltamethrin did not show significant difference in causing larval knockdown of flies at 1 hr after spraying, but lambdacyhalothrin was the most effective pyrethroid at 24 hr after spraying compared to permethrin (LSD, $p < 0.01$) and deltamethrin (LSD, $p < 0.05$) (Tables 2a, 2b).

The results of insecticidal spraying of fly larvae (*M. domestica* and *C. megacephala*) in the field showed that lambdacyhalothrin and deltamethrin were effective in causing high mortality in an area exposed directly to sunlight such as in the garbage dumping ground at Lukut, Port Dickson, compared to permethrin. Our results are in contrast to that of Thomson (1989) which mentioned that permethrin has good residual activity since sunlight does not break it down rapidly.

At the Ceras poultry farm where the insecticides sprayed were not exposed directly to sunlight, all the three insecticides were effective in causing high larval knockdown at 1 hr after treatment. However, at 24 hr after spraying, lambdacyhalothrin was shown to be the most effective compared to deltamethrin and permethrin in causing mortality of *M. domestica* and *C. megacephala* larvae. The above findings indicated that lambdacyhalothrin could be a useful insecticide for controlling the larvae of filth flies in the field.

The efficacy of the pyrethroids in reducing the field population of adult flies was estimated based on the relative scudder grill counts. At the garbage dumping ground, Port Dickson, investigation 1 hr after spraying indicated that lambdacyhalothrin, deltamethrin and permethrin had reduced the adult field population by 82.2, 82.1 and 75.2%, respectively, compared to 28.3% reduction in the control plot. Thus, there was a significant difference between the pyrethroids and that of the control (ANOVA, $p < 0.05$) (Table 1c). However, at 24 hr after spraying there was no significant differ-

Table 1c Mean number of adult fly population at Port Dickson dumping ground sampled by Scudder grill per min (percentage reduction of fly population to that of before spraying in parenthesis).

Insecticide	Mean No. of adult flies		
	Before spraying	1 hr after spraying	24 hr after spraying
Lambdacyhalothrin	614	109 (82.2%)	143 (76.7%)
Deltamethrin	772	138 (82.1%)	135 (82.5%)
Permethrin	738	183 (75.2%)	304 (58.8%)
Control	1,247	894 (28.3%)	701 (43.8%)

One hr after spraying there is significant difference among the population reduction means (ANOVA, $p < 0.05$), but not after 24 hr after spraying (ANOVA, $p > 0.05$).

Table 2a The knockdown of fly larvae 1 hr after spraying at Ceras poultry farm.

Insecticide	% knockdown of fly larvae	Mean (%)
Lambdacyhalothrin	50.3, 74.9, 35.4	53.5
Deltamethrin	55.9, 61.9, 57.1	58.3
Permethrin	56.9, 60.1, 33.1	50.0
Control	5.3, 3.5, 11.7	6.8

There is significant difference among the means (ANOVA, $p < 0.01$). No significant difference between lambdacyhalothrin and deltamethrin (LSD, $p > 0.05$). No significant difference between lambdacyhalothrin and permethrin (LSD, $p > 0.05$).

Table 2b The mortality of fly larvae 24 hr after spraying at Ceras poultry farm.

Insecticide	% mortality of fly larvae	Mean (%)
Lambdacyhalothrin	39.1, 71.0, 74.1	61.4
Deltamethrin	40.0, 12.6, 48.4	33.7
Permethrin	2.7, 24.7, 36.6	21.3
Control	8.8, 0.2, 12.8	7.3

There is significant difference among the means (ANOVA, $p < 0.05$). There is significant difference between lambdacyhalothrin and deltamethrin (LSD, $p < 0.05$). There is significant difference between lambdacyhalothrin and permethrin (LSD, $p < 0.01$).

ence among all treatments (including the control) (ANOVA, $p > 0.05$) (Table 1c).

At the Ceras poultry farm, investigation 1 hr after spraying indicated that between

78.2 and 81.4% of the adult fly population was reduced by the pyrethroids. Nevertheless, there was no significant difference among all treatments (ANOVA, $p > 0.05$) (Table 2c). However, at 24 hr after spraying, lambdacyhalothrin had showed the highest number of adult fly reduction with 77.9% followed by permethrin (65.8%), deltamethrin (56.2%) and control (3.3%), respectively. Thus, there was a significant difference between the treatments (ANOVA, $p < 0.01$) (Table 2c). The above results indicated that as a larvicide in an open space exposed to sunlight, lambdacyhalothrin and deltamethrin were more effective than permethrin. However, in sheltered areas such as the poultry farm lambdacyhalothrin was the most effective. As an adulticide applied at an open space under direct sunlight all the three pyrethroids were effective in reducing the adult population within a short period of 1 hr. However, at 24 hr after treatment there was no significant difference among the pyrethroids although there were reductions in fly populations.

As mentioned earlier, both lambdacyhalothrin and deltamethrin were effective larvicides and further studies over a long period of time could be helpful in reducing the fly population in such study area. Studies at the sheltered poultry farm indicated lambdacyhalothrin was the most effective pyrethroid compared to deltamethrin and permethrin.

Both deltamethrin and permethrin have been recommended by WHO for residual treatment in fly control (WHO, 1984). The new pyrethroid lambdacyhalothrin seems to have the potential to be a vital element for

Table 2c Mean number of adult fly population at Ceras poultry farm sampled by Scudder grill per min (percentage reduction in parenthesis).

Insecticide	Mean No. of adult flies		
	Before spraying	1 hr after spraying	24 hr after spraying
Lambdacyhalothrin	331	62 (81.3%)	73 (77.9%)
Deltamethrin	450	98 (78.2%)	197 (56.2%)
Permethrin	354	66 (81.4%)	121 (65.8%)
Control	331	319 (3.6%)	320 (3.3%)

There is no significant difference among the population reduction (ANOVA, $p > 0.05$) 1 hr after spraying, but there is significant difference 24 hr after spraying (ANOVA, $p < 0.01$).

fly control in public health in the near future.

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摘 要

マレーシアにおける厨芥処分場と鶏舎から発生するハエ類に対するラムダサイハロスリン、デルタメスリンおよびペルメトリンの効力評価

厨芥処分場と鶏舎から発生するイエバエとオビキンバエに対する、3種のピレスロイド剤の効力を比較した。ラムダサイハロスリンとデルタメスリンは厨芥処分場では処理1時間後のハエ幼虫のノックダウン率および24時間後のハエ幼虫死亡率はペルメトリンよりも共に高率であった。鶏舎においては3種のピレスロイドは処理1時間後のハエ幼虫ノックダウン率では同等に効果的であったが、24時間後のハエ幼虫死亡率で見た場合、ラムダサイハロスリンが最も有効であった。