ICON (OMS 3021) THERMAL FOGGING TO CONTROL THE DHF VECTOR *Aedes aegypti* IN UNGARAN SUBDISTRICT, SEMARANG REGENCY.

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ABSTRAK

Untuk mengetahui pengaruh thermal fogging dengan menggunakan ICON 5% EC (OMS 3021), suatu insektisida pyrethroid sintetis yang mengandung bahan aktif lambdacyhalothrin terhadap Aedes aegypti, *telah dilakukan uji coba di Ungaran, Kabupaten Semarang. Uji "air bioassay" menunjukkan bahwa pada tiga dosis yang dipakai yaitu 0,5 g; 1 g dan 2 g (b.a)/ha berhasil membunuh semua* Ae. aegypti *yang diuji (100%).*

Beberapa parameter yang dipakai pada uji coba ini menunjukkan bahwa pada ketiga dosis yang dipakai mampu menekan kepadatan populasi Ae. aegypti *di dalam rumah selama 1; 3 dan 5 minggu setelah fogging masing-masing untuk dosis 0,5 g; 1 g dan 2 g (b.a)/ha. Perubahan perilaku penduduk selama penelitian sedikit banyak berperan juga dalam penurunan populasi tersebut di atas.*

INTRODUCTION

DHF has been a problem for sometime, regular vector control methods are being implemented such as malathion thermal fogging and distribution of temephos for existing water containers. Since 1972, malathion has been used for controlling the DHF vector *Aedes aegypti* in Indonesia and it was found effective in the past.[1] Suharyono (1988) revealed that malathion thermal fogging in foci of DHF cases and 100 m surroundings did not reduce adult *Ae. aegypti* densities significantly.[2] Fox and Specht (1988) reported that landing counts made in a residential area in Puerto Rico during a 5 years period indicated that ULV (Ultra Low Volume) ground applications of malathion was not effective against *Ae. aegypti*.[3] Malathion ULV aerial spraying in a wide area is known to result in the immediate reduction of vector population. However, the mosquitoes population will increase again soon because of a lack of residual effect.

ICON is a synthetic pyrethroid insecticide containing the active ingredient of lambdacyhalothrin. It has been found to posses a residual effect up to 40 days against Ae. aegypti at a dosage rate of 5 mg/m2.[4] A study conducted in Malaysia using ICON as thermal fog at a dosage of 0.25 g/ha was able to kill *Ae. aegypti* at a distance of 10 and 25 meters from the fogging point (open field) resulting in 93.9% and 87.5% mortality, respectively.[5]

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Considering these information, a trial was carried out to evaluate the effect of ICON thermal fogging to control *Ae. aegypti* in Ungaran, Semarang Regency. The aim of this study is to obtain an alternative insecticides to cope with vector control problems.

MATERIALS AND METHOD

Locations

Four villages were selected in Ungaran subdistrict, Semarang regency as a study areas (Fig.1). The study was conducted on December 1988 - February 1989.

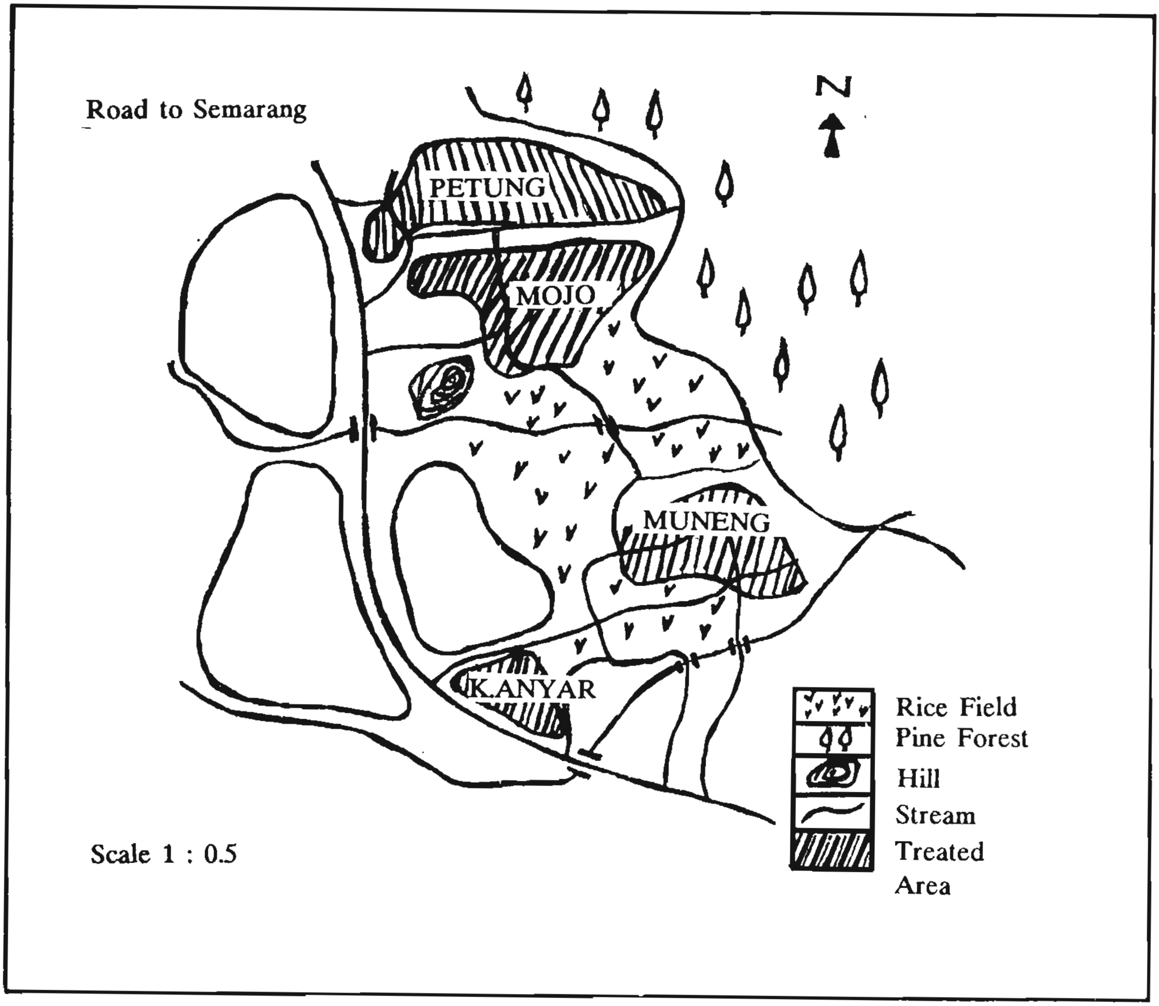


Fig.1. Map showing study area

1. Petung

This village is approximately 28 ha and consisted of 172 houses. Water is supplied from wells. Regular water containers are earthen-ware jars, cement cistern and plastic buckets. This area was used to test ICON with a dosage of 2 g (a.i)/ha.

2. Mojo

This village is approximately 58 ha and consisted of 317 houses. Water is supplied from wells. Regular water containers are the same as in Petung. This area was used to test ICON with a dosage of 1 g (a.i)/ha.

3. Muneng

This village is approximately 92 ha and consisted of 536 houses. Water is supplied by the municipality and water containers were similar to those from the two other villages. This area was used to test ICON with a dosage of 0.5 g (a.i)/ha.

4. Karanganyar

This village is approximately 10 ha and contains 165 houses. The ecosystem of this village is similar to the other villages. Water is supplied by municipality however some of the inhabitants also used well water. Water containers were similar to those of the other villages. This area was used as a control or untreated area.

Fogging Implementation

Thermal fogging was conducted in 2 cycles with an interval of one week. The insecticide used was ICON 5% EC. Fogging was conducted with a thermal fog IGEBA machine type TF 30/F 40 with nozzel jet 1.6 (35 l suspension/hour). Thermal fogging was perfomed in the morning on all houses/buildings and shrubs surrounding them. Fogging was done through doors and windows for about 1 to 2 minutes without entering the house. If fogging was done through the doors, windows were shut. Keep the house closed nearly half to an hour after fogging.

Entomological Evaluation

1. Air bioassay test

Air bioassay test was performed by hanging a cage (12 x 12 x 12 cm3) containing 25 blood fed mosquitoes. Cages were hung 1.5 m above ground. The test was conducted in three houses, and cages were located in each livingroom and kitchen. Outdoor bioassay test were conducted by hanging cages outdoors in the garden. Cages were installed before fogging and cages were monitored respectively 5; 10 and 15 minutes after fogging; mosquitoes were kept in plastic cups and observed after 24 hours. Control mortality, if any, was corrected by using Abbot's formula.[6]

2. Mosquitoes Collections

Mosquito collections were carried out weekly in the treated and control areas before (4 times) and after (6 times) fogging by using methods of :

- Mosquitoes landing on man indoors and outdoors, 15 minutes/house, from 06.30 - 11.30 (covering 20 houses).
- Mosquitoes resting indoors and outdoors, 15 minutes/house, from 06.30 - 11.30 (covering 20 houses).

3. Ovitrap Collections

Ovitraps were installed in the treated and control areas, 10 indoors and 10 outdoors respectively. these traps were located close to the breeding habitat or close to the resting place; traps were monitored weekly. Eggs were collected and counted.

4. Larval Survey

Larval surveys were conducted weekly in 50 houses each in the treated and control areas.

RESULTS AND DISCUSSIONS

Air bioassay tests conducted indoors and outdoors in the four areas are presented in Table 1. The gradual exposure of 5; 10 and 15 minutes in air bioassay tests also shows a gradual increase in the mortality. After 24 hours, mortality of 100% and 9.13% were obtained for all dosages investigated and control, respectively. The differences of mosquitoes number tested in each site as shown in Table 1 due to inadequate stock number of laboratory's strain of *Ae. aegypti*.

Table 1. Percent mortality of *Ae. aegypti* in air bioassay tests of two cycles ICON (OMS 3021 5% EC thermal fogging.

Hamlet	Dosage	Exposure time	Location of cages					
			Living room		Kitchen		Outdoor	
			No.test*	KD%	No.test*	KD%	No.test*	KD%
Petung	2 g	5'		42.59		38.70		38.64
	(a.i)/ha	10'	54	62.96	31	64.52	44	61.36
		15'		75.92		96.77		95.45
		24 h**		100.00		100.00		100.00
Mojo	1 g	5'		37.38		36.67		28.89
	(a.i)/ha	10'	45	48.88	30	50.00	45	37.77
		15'		97.77		76.67		77.78
		24 h**		100.00		100.00		100.00
Muneng	0.5 g	5'		64.44		66.67		75.55
	(a.i)/ha	10'	45	91.11	30	73.33	45	86.67
		15'		100.00		100.00		100.00
		24 h**		100.00		100.00		100.00
Control		5'		0.00				0.00
		10'	90	0.00			90	0.00
		15'		0.00				0.00
		24 h**		11.66				6.61

KD : Knock Down

* : Cumulative number of mosq. tested on 2 cyccles of fogging

** : After 24 hours holding.

Evaluation of application methods of ICON 5% EC at weekly intervals in the treated areas against *Ae. aegypti* using landing and resting collections made indoors and outdoors are shown in Table 2. The densities of *Ae. aegypti* landing on man in treated areas (Muneng; Mojo and Petung) were reduced until 5 weeks after fogging. The mosquito densities declined from about 0.00 ; 0.40 and 0.27 per man/hour before fogging to 0.00 per man/hour after fogging in Muneng, Mojo and Petung, respectively. The mosquito densities in the control area were also reduce until 5 weeks after fogging, namely from about 0.13 per man/hour to 0.00 per man/hour. The reduced density of *Ae. aegypti* in the treated and control areas did not differ significantly, because the mosquito densities before fogging in the both areas were low.

Table 2. Density (per man/hour) of *Ae. aegypti* in treated and control area before and after fogging.

Biotope		Aver.before fogging	Weeks after fogging				
			1	2	3	4	5
Landing on man							
Indoor	A*	0.00	0.00	0.00	0.00	0.00	0.00
	B*	0.40	0.00	0.00	0.00	0.00	0.00
	C*	0.27	0.00	0.00	0.40	0.00	0.00
	D	0.13	0.80	0.00	0.00	0.80	0.00
Outdoor							
	A*	0.00	0.00	0.00	0.00	0.00	0.00
	B*	0.00	0.00	0.00	0.00	0.00	0.00
	C*	0.00	0.00	0.00	0.00	0.00	0.00
	D	0.00	0.00	0.00	0.00	0.00	0.00
Resting							
Indoor	A*	0.53	0.00	0.00	0.40	0.00	0.00
	B*	0.60	0.00	0.00	0.00	0.00	0.40
	C*	1.20	0.00	0.00	0.00	1.20	0.00
	D	4.27	3.20	2.00	1.60	0.80	2.40
Outdoor							
	A*	0.00	0.00	0.00	0.00	0.00	0.00
	B*	0.00	0.00	0.00	0.00	0.00	0.00
	C*	0.00	0.00	0.00	0.00	0.00	0.00
	D	0.00	0.00	0.00	0.00	0.00	0.00

* Treated Area

A. Muneng 0.5 g (a.i)/ha

B. Mojo, 1.0 g (a.i)/ha

C. Petung, 2.0 g (a.i)/ha

Diurnal resting of *Ae. aegypti* population in houses of the treated areas were reduced until 5 weeks after fogging, however a reductions also evident in the control area. In Petung, Mojo, Muneng and the control area the mosquito densities declined from average of 1.20; 0.60; 0.53 and 4.27 per man/hour before fogging to 0.00; 0.40; 0.00 and 2.40 per man/hour after fogging. After fogging the reduced density of *Ae. aegypti* occured in the treated as well as the control area, however, an significant difference of *Ae. aegypti* densities was observed between treated and control areas. No *Ae. aegypti* mosquitoes have been caught landing on man and resting outdoors in the control and treated areas.

The average number of eggs per positive ovitraps deployed inside houses are given on Fig .2. In Muneng (Fig.2 a), the treated area of 0.5 g (a.i)/ha, the average number of eggs was reduced from 41 to 22 eggs/positive ovitraps for about one week after fogging and it fluctuated until the end of this study. The average number of eggs in Mojo and Petung (Fig.2 b;c), the treated area of 1 and 2 g (a.i)/ha, were reduced from 38 and 32 to 16 and 17 eggs/positive ovitrap for about 3 and 5 weeks after fogging, respectively.

Fig. 2. Weekly fluctuation of average number of eggs per positive ovitraps indoors for *Ae. aegypti* before and after fogging in treated and control area.

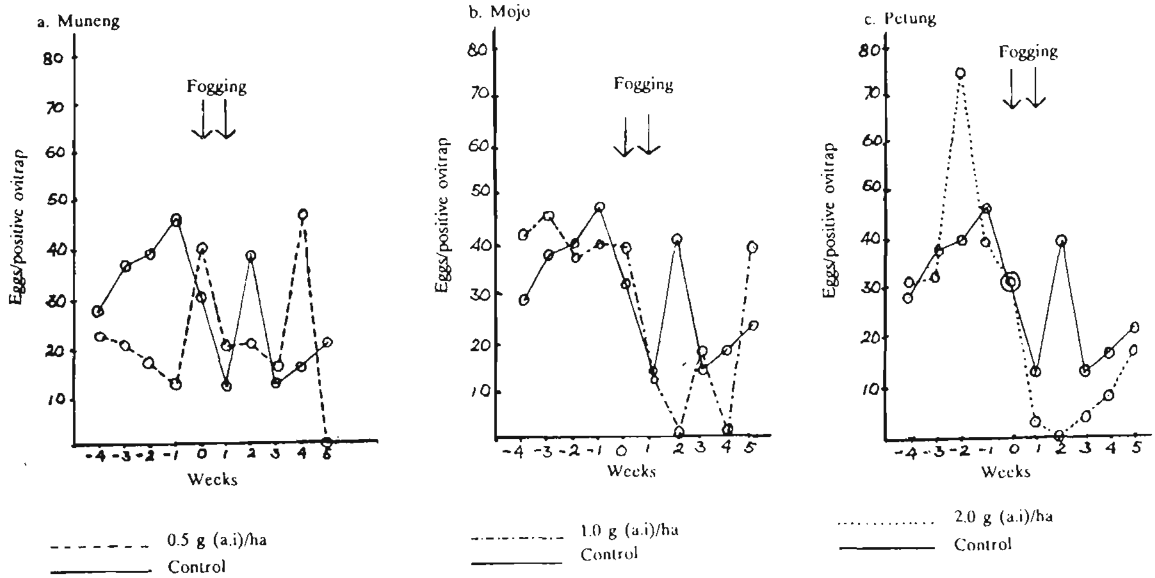
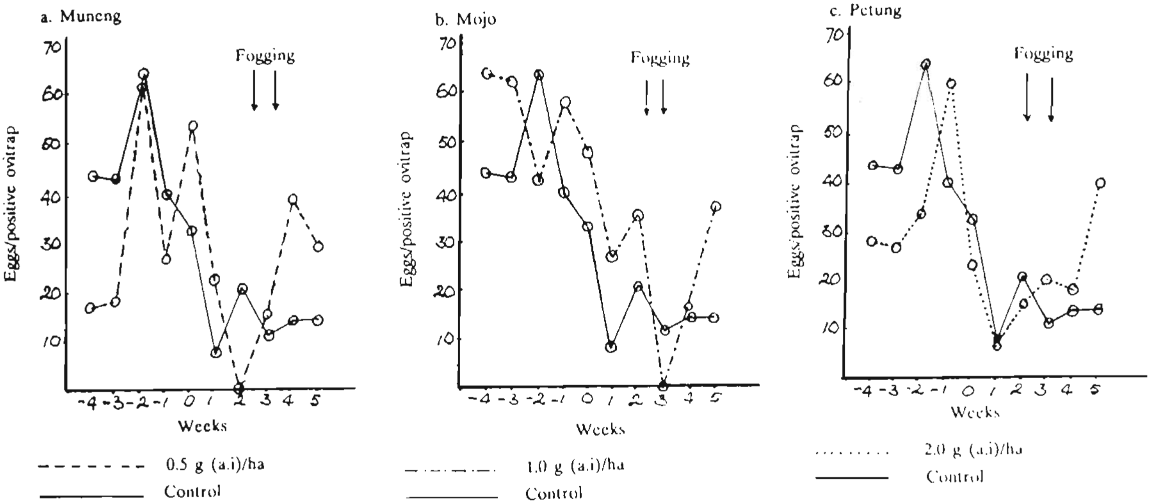


Fig.3 shows the weekly fluctuation in the average number of eggs per positive ovitrap outdoors collected from treated and control areas. One to two weeks after fogging,there was a reduction in the average number of eggs in the treated areas, Muneng, Mojo and Petung from 53, 47 and 25 to 0, 0 and 15 respectively (Fig.3 a;b;c), however, it increases again until the 5th week.

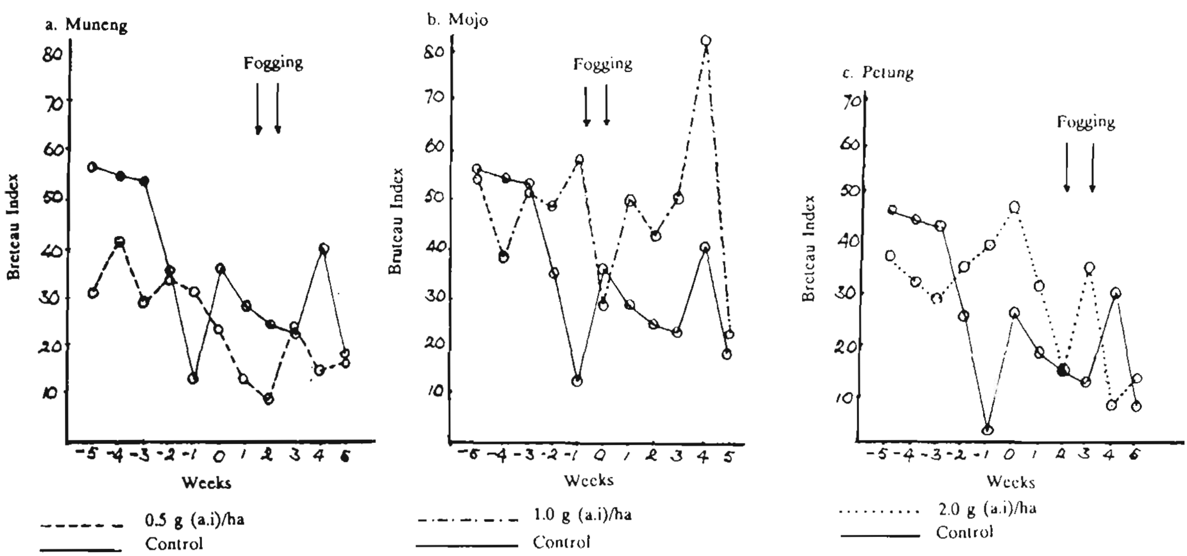
Fig. 3. Weekly fluctuation of average number of eggs per positive ovitraps outdoors for *Ae. aegypti* before and after fogging in treated and control area.



The results showed that weekly fluctuation in the average number of eggs per positive ovitraps indoors after fogging are negatively correlated to outdoors. This fact may be due to repellent effect of insecticide that remain adhered to the wall inside the houses while fogging. So that the activity of *Ae. aegypti* moved from indoors to outdoors, including oviposition.

Fig.4 shows the Bruteau Index (BI) in the treated and control areas before and after fogging. At the end of this study period, the BI in the control area had declined from 41 to 26. The BI in Muneng and Petung (Fig.4 a;c) had declined from 41 and 31 to 30 and 26, respectively. On the other hand, the BI in Mojo (Fig.4 b) had slightly increased from 46 to 49.

Fig. 4. Weekly fluctuation of Breteau Index for *Ae. aegypti* before and after fogging in treated and control area.



Overall, during this study the inhabitants in the trial area cleaned their water containers and houses due to regular check every week because of the survey, hence it influenced the *Ae. aegypti* population e.g. reduction of population density and BI.

It means that the reduction of *Ae. aegypti* population in houses is not only due to thermal fogging application of ICON, but also due the behaviour of the people.

CONCLUSION

The various parameters monitored showed that two cycles of thermal fogging application of ICON (OMS 3021) 5% EC with one week interval reduced the densities of *Ae. aegypti* indoors for about 1; 3 and 5 weeks at a dosages of 0.5; 1 and 2 g (a.i)/ha respectively.

The reduction of *Ae. aegypti* population was also contributed by an unexpected behavioural changes of the people during the survey.

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