

A FIELD STUDY ON THE EFFECTS OF RESIDUAL SPRAY OF ENCAPSULATED FENITROTHION ON *ANOPHELES MINIMUS* POPULATION IN PHARE PROVINCE, NORTHERN THAILAND

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Abstract: A field study was carried out in 2 villages of Phare Province, Thailand to evaluate effect of the residual spraying of a microcapsulated formulation of 20% fenitrothion (Sumithion 20 MC[®]) on *Anopheles minimus* populations. In the treatment village, houses were sprayed with 1 g/m² of fenitrothion, except for 2 houses which were selected to spray with 0.5 g/m² of fenitrothion for comparative bio-assay test. The results of bio-assay test showed that mortality of *An. minimus* was 100% in 1 g/m²-30 minutes until 4 months after the spray. The growth rate of *An. minimus* population during the first 4 months of the study period in the treatment village was lower than that in the control area. These results suggested that the residual spray of fenitrothion microcapsules at the beginning of the dry season was effective at least for 4 months after the spray and could suppress the density of *An. minimus*.

Key words: Residual spray, Fenitrothion, Microcapsule, *Anopheles minimus*, Thailand

INTRODUCTION

DDT has played an important role in the vector control until recent years in developing countries. However, the behavioral and/or physiological resistance of mosquitoes have been developed by the continuous application of DDT (WHO, 1992). It has become a serious problem in vector control in many countries, in addition to the side effects of DDT on the surrounding environment through the biological concentration (Curtis, 1994).

In Thailand DDT has been used on a large scale for the malaria vector control since 1952. The physiological and behavioral resistance to DDT have been observed in some anopheline species in Thailand (WHO, 1970, 1992). The screening of alternative insecticide to DDT has become an important subject in the vector control, though it has been believed that the major malaria vectors, *Anopheles minimus* and *An. dirus*, have been still susceptible to DDT (Ismail *et al.*, 1974, 1975; Nutsathapana *et al.*, 1986). Since 1982 fenitrothion has been introduced to some areas as another candidate of insecticide. In 1988 a field study on the response of *An. dirus* to DDT and fenitrothion was conducted and the

results suggested the presence of behavioral resistance (Suwonkerd *et al.*, 1990). In this study effects of the residual spray of a microcapsulated formulation of 20% fenitrothion (Sumithion 20 MC[®]) on *An. minimus* were examined in northern Thailand.

MATERIALS AND METHODS

The study was carried out from October 1995 to September 1996 in 2 villages in Saeipt Canton, Song District, Phare Province, 245 km east of Chiangmai City, Thailand. One village (No. 8 Ban Tawa) where 67 houses were situated and the population=272 was selected as the treatment area. The other village (No. 5 Ban Mae Ten) was selected as the control area where 89 houses were situated and the population was 340.

Among the houses in the treatment area, 2 houses were selected to spray with 0.5 g/m² of encapsulated fenitrothion for the comparative bio-assay test and the other houses were sprayed with 1 g/m² in October, 1995.

Before the insecticide spray, mosquito collections were performed in 4 successive nights. Monthly mosquito collection (4 nights) was conducted by 3 different methods for 1 year after the spray. Using human baits,

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2 different collections, indoor and outdoor human bait collections were made from 18:00 to 24:00 at 2 fixed houses. A pair of collectors sat inside and outside of the houses and landing mosquitoes were collected by an aspirator hourly for 50 min. In the 3rd collection method (the animal bait collection), a cow was tethered inside a gauze net (4×4×2 m), which was similar to the one described by Service (1993), and one collector caught mosquitoes landing in and out of the net using an aspirator at every 15 min. During the collection period relative humidity and temperature were recorded.

Following WHO (1970) the bio-assay test was made every month for 2 different dosage (0.5 and 1 g/m² of fenitrothion) and 2 different periods of exposure (3 and 30 min) using 100-200 *An. minimus* adults reared in the laboratory. The test was duplicated in each combination.

For the bio-assay test the mortality was calculated for each replication and the average of the 2 replications was shown in the table. The average number of *An. minimus* per half night was calculated for each collection method and the growth rate of *An. minimus* population during the first 4 months of the study period was estimated by applying log regression analysis to the average number of *An. minimus*+1.

RESULTS AND DISCUSSION

The results of bio-assay test showed that mortality of *An. minimus* was 100% until 3 months after the spray in all combinations (Table 1). Only the combination of the higher dosage with 30 min exposure showed 100% of mortality until 4 months after the spray. The difference in the effective period between 2 dosage, 0.5 g/m² and

Table 1 The result of bio-assay test of *An. minimus* on the residual deposits of 20% microcapsulated fenitrothion sprayed from October 1995 to September 1996 in Phare, Thailand

Time after spray (month)	0.5 g/m ² *		1 g/m ² *	
	3 min**	30 min**	3 min**	30 min**
0	100	100	100	100
1	100	100	100	100
2	100	100	100	100
3	100	100	100	100
4	9	49	52	100
5	7	44	12	95
7	9	40	14	78
9	10	25	17	47
10	11	35	15	48
11	14	34	18	40

The total number of mosquitoes used in each test was 100-200 and mortality rate of the control mosquitoes was 0 in all the bio-assay test.

* Dosage of fenitrothion

** Exposure time

1 g/m², was about 1 month, and the higher dosage always showed the higher mortality.

The temporal changes in the number of *An. minimus* collected by 3 different methods are depicted in Fig. 1. The density of *An. minimus* declined after the insecticide spray, except for the result of animal bait collection in the control area, and started to increase in May 1996. Although the observed temporal changes in the density may be partly ascribed to the seasonal prevalence of this species in northern Thailand (Takagi *et al.*, 1995; Suwonkerd *et al.*, 1995), the density of indoor and outdoor collection in the treatment area decreased more rapidly from November to December 1995 than the control area.

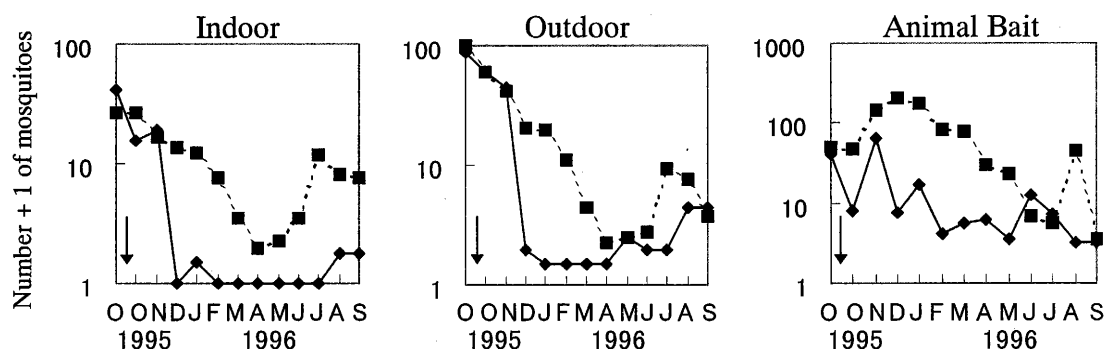


Figure 1 Temporal changes in the number of *An. minimus*/half night collected by 3 different methods from October 1995 to September 1996 in 2 villages in Phare, Thailand. The solid and dashed line shows the result in the treatment and control village, respectively. The arrow shows the day of residual spraying of 1 g/m² of microcapsulated fenitrothion in the treatment village.

Table 2 Results of log regression analysis of the temporal changes in the number of *An. minimus* collected by 3 different methods in the control and treatment area* from October 1995 to February 1996, Phare, Thailand

	Indoor		Outdoor		Animal Bait	
	Treatment	Control	Treatment	Control	Treatment	Control
Slope (<i>b</i>)	-0.35	-0.123	-0.468	-0.18	-0.111	0.059
S.E.	0.126	0.017	0.132	0.023	0.153	0.09
Growth rate/ month (10 ⁶)	0.447	0.753	0.340	0.661	0.775	1.146
Correlation coefficient (<i>r</i>)	0.721	0.944	0.808	0.953	0.149	0.125

*Houses were sprayed with 1 g/m² of microcapsulated fenitrothion in October 1995.

Because the bio-assay test showed that the sprayed insecticide was effective at least for the first 4 months of the study period, the growth rate of the average number of *An. minimus* during the first 4 months (from October 1995 to February 1996) was estimated and compared in Table 2. Both indoor and outdoor collections, the slope of log regression line (*b*) in the treatment area was significantly smaller than that in the control area. The growth rate in the control area was estimated as 0.753 and 0.661/month for indoor and outdoor collections, respectively, and that in the treatment area was 0.447 and 0.340/month for indoor and outdoor collections, respectively. Though the log regression was not significant in the animal bait collection, the difference between the treatment and control area was clear; the density of *An. minimus* in the control area showed gradual increase whereas that in the treatment area showed decreasing tendency during the first 4 months of the study period (Fig. 1).

All the results suggested that the residual spray of capsulated fenitrothion at the beginning of the dry season was effective at least for 4 months after the spray and could suppress the density of *An. minimus*. However the present study started from the declining period of *An. minimus* population, thus, the effect of the insecticide sprayed might be overestimated in this study. Additional field studies in the increasing period of *An. minimus* population will be needed to evaluate the effect of the residual spray of microcapsulated fenitrothion in malaria vector control throughout the year.

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