TABLE OF CONTENTS

TABLE OF CONTENTS	i
LIST OF TABLES	iii
LIST OF FIGURES	vi
LIST OF ABBREVIATIONS	ix
INTRODUCTION	1
General Introduction Purpose of Research Scope of Research	1 4 5
LITERATURE REVIEWS	6
 Part 1; Risk factors and base line malaria knowledge from different pesticide land-use systems in malaria endemic area at Kanchanaburi Province, Thailand. Part 2; Biting peak and population dynamics of <i>Anopheles minimus</i> species A, from high and low agricultural insecticide area in the two villages at Kanchanaburi Province, Thailand. 	6 7
Part 3; Behavioral responses by Anopheles minimus species A and C	
to three agrochemicals. Part 4; Behavioral responses by <i>Anopheles minimus</i> species A and species C to DDT and pyrethroids.	9 13
MATERIALS AND MEDTHODS	15
	10
 Part 1; Risk factors and base line malaria knowledge from different pesticide land-use systems in malaria endemic area at Kanchanaburi Province, Thailand. Part 2; Biting peak and population dynamics of <i>Anopheles minimus</i> species A, from high and low agricultural insecticide area in the two villages at Kanchanaburi Province, Thailand. 	16 22
Part 3; Behavioral responses by <i>Anopheles minimus</i> species A and C	
to three agrochemicals.	33
Part 4; Behavioral responses by <i>Anopheles minimus</i> species A and species C to DDT and pyrethroids.	38

TABLE OF CONTENTS (CONTINUED)

RESULTS	41
Part 1; Risk factors and base line malaria knowledge from different pesticide land-use systems in malaria endemic area at Kanchanaburi Province, Thailand.	41
Part 2; Biting peak and population dynamics of <i>Anopheles minimus</i> species A, from high and low agricultural insecticide area in the two villages at Kanchanaburi Province, Thailand.	53
Part 3; Behavioral responses by <i>Anopheles minimus</i> species A and C to three agrochemicals.	62
Part 4; Behavioral responses by <i>Anopheles minimus</i> species A and species C to DDT and pyrethroids.	70
DISCUSSION	78
Part 1; Risk factors and base line malaria knowledge from different pesticide land-use systems in malaria endemic area at Kanchanaburi Province, Thailand.	78
Part 2; Biting peak and population dynamics of <i>Anopheles minimus</i> species A, from high and low agricultural insecticide area in the two villages at Kanchanaburi Province, Thailand.	84
Part 3; Behavioral responses by <i>Anopheles minimus</i> species A and C to three agrochemicals.	88
Part 4; Behavioral responses by <i>Anopheles minimus</i> species A and species C to DDT and pyrethroids.	90
CONCLUSION	93
RECOMMENDATION	96
LITERATURE CITED	97
APPENDIX	113

Page

LIST OF TABLES

Table		Page
1	Names and locations of surveyed villages.	42
2	Village names, population, number of houses and huts, and total number of respondents.	42
3	Demographic and general characteristics of interviewed household heads in Kanchanaburi.	43
4	Household head ethnicity	43
5	Year living in village	44
6	Number of adult and children in the village	44
7	Respondents occupation	44
8	Problems and diseases	45
9	Travel out of the villages	45
10	Malaria knowledge of the household heads	46
11	Treatment after got malaria of the household heads	47
12	The preventative of malaria (mosquitoes)	47
13	Number of bed nets in household (from 83% of 232 household head)	48
14	Frequency of household heads sleep in field hut	48
15	Animal around house	49
16	Pesticides used in each village	49
17	Other pesticides used in each village	50
18	Number of <i>Anopheles minimus</i> species A collected through out the year compare between the two collecting sites, MNN and BTN.	55
19	Number of <i>Anopheles minimus</i> species A collected through out of the year compare between the six collecting sites in Kanchanaburi province, Thailand.	55
20	Number of <i>Anopheles minimus</i> species A collected each hour through out the year compare between low chemical location (MNN) and highchemical location (BTN) in Kanchanaburi province, Thailand.	56

LIST OF TABLES (CONTINUED)

Table		Page
21	Larvae of <i>Anopheles minimus</i> species A collected each season through out the year compare between two collecting sites, MNN and BTN.	56
22	Number of female and larvae of <i>Anopheles minimus</i> species A collected through out of the year compare between two collecting sites, MNN and BTN.	57
23	The statistic of the caught female of <i>An minimus</i> A comparison between MNN and BTN in each season	57
24	The statistic of the collected larvae of <i>An minimus</i> A comparison between MNN and BTN in each season	58
25	Climatological data as recorded from the meteorological station in Thong Pha Phum (TPP) and Sai Yok (SY) district Kanchanaburi Province, average in one year.	58
26	Percentage escape response and mortality of <i>Anopheles minimus</i> A and C exposed to carbaryl, malathion and cypermethrin in contact and non contact trials	64
27	Estimated escape time (ET) at 30, 50, and 70 minutes for <i>Anopheles minimus A and C</i> in contact with 0.4 g/m ² carbaryl, 0.19 g/m ² malathion and 0.04 g/m ² cypermethrin	65
28	Log-rank comparisons of escape responses between two species in contact and noncontact trials.	66
29	Log-rank comparisons of escape responses between control and contact, contact and non-contact, and control and non contact trials for two strains of <i>An. minimus</i>	67
30	Percentage escape response and mortality of <i>Anopheles minimus</i> A and C exposed to DDT, deltamethrin and lambda-cyhalothrin in contact and non contact trials	72
31	Estimated escape time (ET) at 50, 75, and 90 minutes for <i>Anopheles</i> minimus A and C in contact with 2 g/m ² DDT, 0.02 g/m ² deltamethrin and 0.03 g/m ² lambda-cyhalothrin	73

LIST OF TABLES (CONTINUED)

Table		Page
32	Log-rank comparisons of escape responses between two species in contact and noncontact trials.	74
33	Log-rank comparisons of escape responses between control and contact, contact and non-contact, and control and non contact trials for two strains of <i>An. minimus</i>	75

LIST OF FIGURES

Figure		Page
1	Map showing the location for adult and larval of <i>Anopheles minimus</i> species complex collection.	17
2	Farmer system survey to six villages in Thong Pha Phum and SaiYok District, Kanchanaburi Province, Thailand	18
3	Contacted to local peoples by interviewing with questionnaire 1 and questionnaire 2.	21
4	Map of Mae Num Noy village (MNN) (only part of Rubber forest village) showing 3 stations for adult collection and 10 points on 2 breeding sites for larvae collection.	23
5	The right picture is a pool (HP) which is located beside a road in the village and the left picture is a shallow waterway connected this pool with the ST habitat.	24
6	A small stream (ST) running along a garden in the village.	24
7	Map of Bong Ti Noy village (BTN) showing three stations for adult collection and 10 points on two breeding sites for larvae collection	26
8	A large perennial stream (Bst) which runs along the BTN village.	27
9	A small perennial stream (Sst) running along a road in BTN village.	27
10	Mosquitoes collecting by outdoor human bait catches	28
11	The three sites were undertaken during the night by two teams of two persons each at each site.	29
12	Collected mosquitoes were placed in separate marked plastic cups, all alive mosquito specimens were provided with 10% sugar solution and transported to the field laboratory for morphological	20
	identification	30
13	Species identification was carried out by stereo-microscope.	30
14	Anopheles minimus species A	30
15	Larval and pupal stages of anopheline mosquitoes were collected using the dipping method.	32

LIST OF FIGURES (CONTINUED)

Figure		
16	Exito-repellency test chamber model	35
17	Exito-repellency test chamber were designed to compare two field populations of the wild caught species in contact and non-contact exposures using insecticide treated papers.	35
18	Excito-repellency test chamber used to study insecticide behavioral responses.	40
19	Pesticides used in each village	50
20	Other pesticides used in each village	51
21	Other pesticides and herbicides used in each village	52
22	Number of <i>Anopheles minimus</i> species A collected through out the year compare between the two collecting sites, MNN and BTN.	59
23	Number of <i>Anopheles minimus</i> species A collected each hour through out the year compare between the two collecting sites.	59
24	Number of <i>Anopheles minimus</i> species A collected each hour on three season compare between the two collecting sites, MNN and BTN.	60
25	Larvae of <i>Anopheles minimus</i> species A collected through out the year compare between the four collecting sites in Kanchanaburi Province, Thailand.	60
26	Number of female and larvae of <i>Anopheles minimus</i> species A collected through out the year compare between two collecting sites, MNN and BTN.	61
27	Escape probability of <i>Anopheles minimus</i> species A and C exposed to carbaryl and paired control chamber for contact and non-contact trials	68
28	Escape probability of <i>Anopheles minimus</i> species A and C exposed to malathion and paired control chamber for contact and non-	68
	contact trials.	00

Page

LIST OF FIGURES (CONTINUED)

Figure

29	Escape probability of <i>Anopheles minimus</i> species A and C exposed to cypermethrin and paired control chamber for contact and non-contact trials.	69
30	Escape probability of Anopheles minimus species A and C exposed to DDT and paired control chambers for contact and non-contact trials.	76
31	Escape probability of Anopheles minimus species A and C exposed to deltamethrin and paired control chambers for contact and non-contact trials.	76
32	Escape probability of Anopheles minimus species A and C exposed to lambda-cyhalothrin and paired control chambers for contact and non-contact trials.	77
33	Escape probability of Anopheles minimus species A and C exposed to DDT, deltamenthrin (DEL), and lambda-cyhalothrin (LAM) in non-contact trials.	77

Page

LIST OF ABBREVIATIONS

An	=	Anopheles
BTN	=	Bong Ti Noy village
Bst	=	Big stream
cm	=	Centimeter
Fig	=	Figure
g	=	Gram
HP	=	Hans' Pool
h	=	Hour
1000		
MNN	=	Mae Num Noy village
MNN mg	=	Mae Num Noy village Milligram
mg		Milligram
mg ml	=	Milligram Milliliter
mg ml P	= =	Milligram Milliliter Probability Value
mg ml P Sst	= = = =	Milligram Milliliter Probability Value Small stream