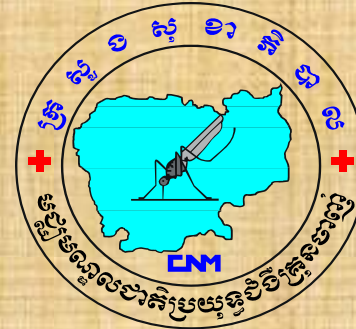


# INSECTICIDE RESISTANCE OF MALARIA VECTOR IN CAMBODIA



The continue activities of Malvecasia project.

Dr Tho Sochantha

Luang Prabang

15-17 March 2010

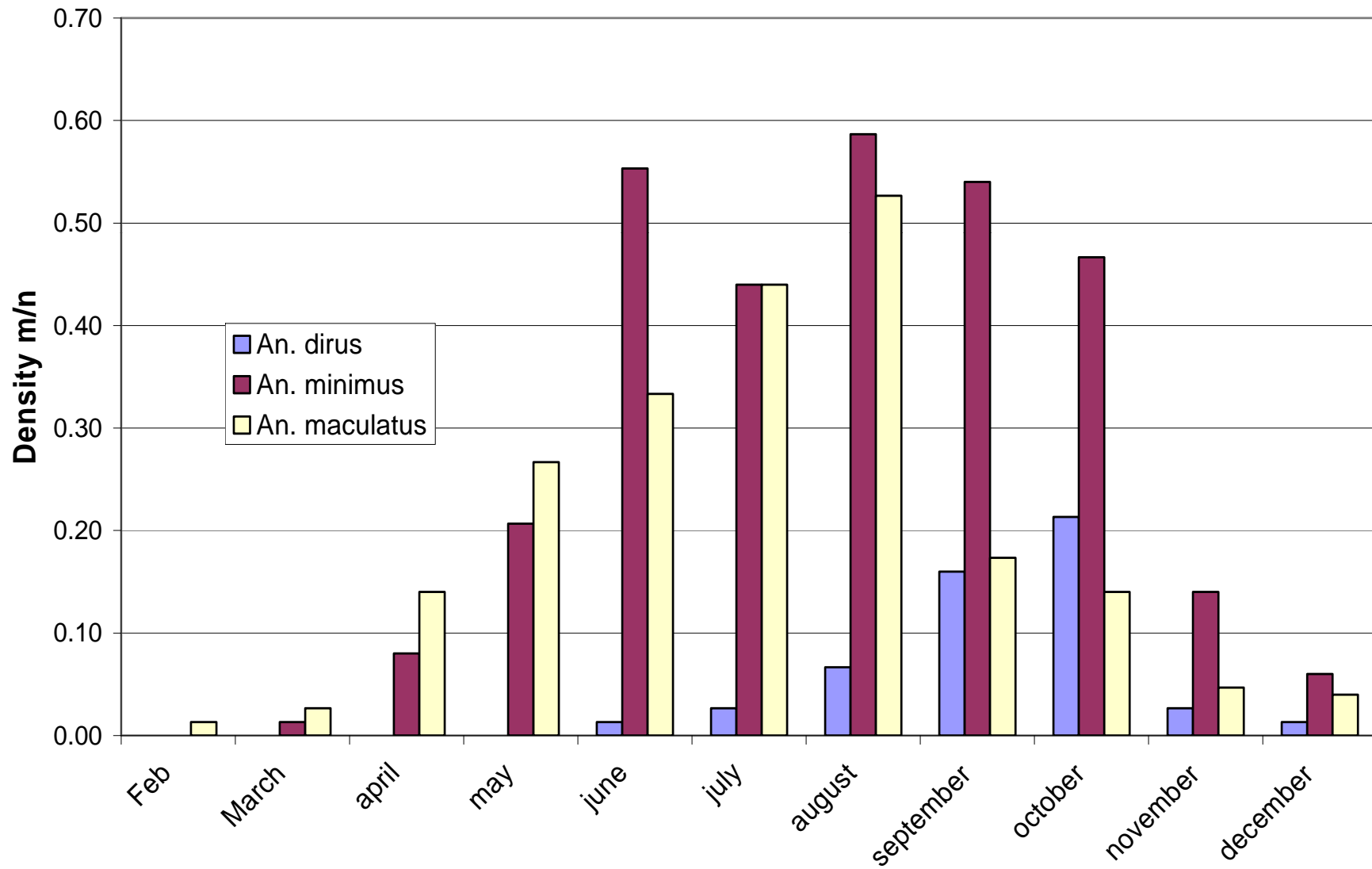
**Indoor 1 and outdoor 2 human landing rates  
(number of mosquitoes per man per night) of  
*An. minimus* A and *An. dirus* A in Cha Ong Chan  
(Rattanakiry, Cambodia)**

<b>Village</b>	<b>Species</b>	<b>Human landing</b>	<b>March 1999</b>	<b>July 1999</b>	<b>October 1999</b>
<b>Cha Ong Chan</b> <b>(Rattanakiry,</b>	<i>An. minimus</i> <b>A</b>	<b>Indoor</b>	<b>0.15</b>	<b>0.05</b>	<b>0.25</b>
		<b>Outdoor</b>	<b>0.30</b>	<b>0.25</b>	<b>0.18</b>
<b>Cambodia)</b>	<i>An. dirus</i> <b>A</b>	<b>Indoor</b>	<b>0.00</b>	<b>0.40</b>	<b>0.00</b>
		<b>Outdoor</b>	<b>0.00</b>	<b>0.58</b>	<b>0.05</b>

## Total caught mosquitoes in Rattanakiri Leutouch village 2008

No	species	OH	Density OH	IH	Density IH	Ratio OH/IH	Total HLC	Density HLC	OC	Density OC	Ratio HLC/OC
1	An. dirus	75	0.75	3	0.06	12.50	78	0.52	3	0.03	17.33
2	An. minimus	407	4.07	54	1.08	3.77	461	3.07	115	1.15	2.67
3	An. maculatus	302	3.02	20	0.4	7.55	322	2.15	272	2.72	0.79
4	An. kawari	98	0.98	12	0.24	4.08	110	0.73	105	1.05	0.70
5	An. vagus	196	1.96	10	0.2	9.80	206	1.37	1047	10.47	0.13
6	An barbirotris	56	0.56	5	0.1	5.60	61	0.41	81	0.81	0.50
7	An.jamasi	41	0.41	13	0.26	1.58	54	0.36	285	2.85	0.13
8	An Philippine nsis	238	2.38	5	0.1	23.80	243	1.62	976	9.76	0.17
9	An. tesselatus	7	0.07	0	0		7	0.05	19	0.19	0.25
10	Kochi	79	0.79	2	0.04	19.75	81	0.54	28	0.28	1.93
11	An.sinensis	0	0	0	0		0	0.00	1	0.01	0.00
12	An. umbrosis	0	0	0	0		0	0.00	1	0.01	0.00

Figure 3: **Seasonal fluctuation in Rattanakiri 2008**



**Total caught and density Anophele in Lam Village  
Rattanakiri 8 nights consecutive in the high season 2009**

No	Species	TOTAL			Density/ m/n		
		OC	OH	IH	OC	OH	IH
1	<i>dirus s.l</i>	3	12	4	0.38	1.50	0.50
2	<i>minimus s.l</i>	15	44	25	1.88	5.50	3.13
3	<i>maculatus s.l</i>	13	26	2	1.63	3.25	0.25

Total caught and density Anophele in Phi Village 8 nights consecutive:

OH out human landing collection, IH Indoor, OC collects on Cattle.

Density of man is number of mosquitoes/man/night.

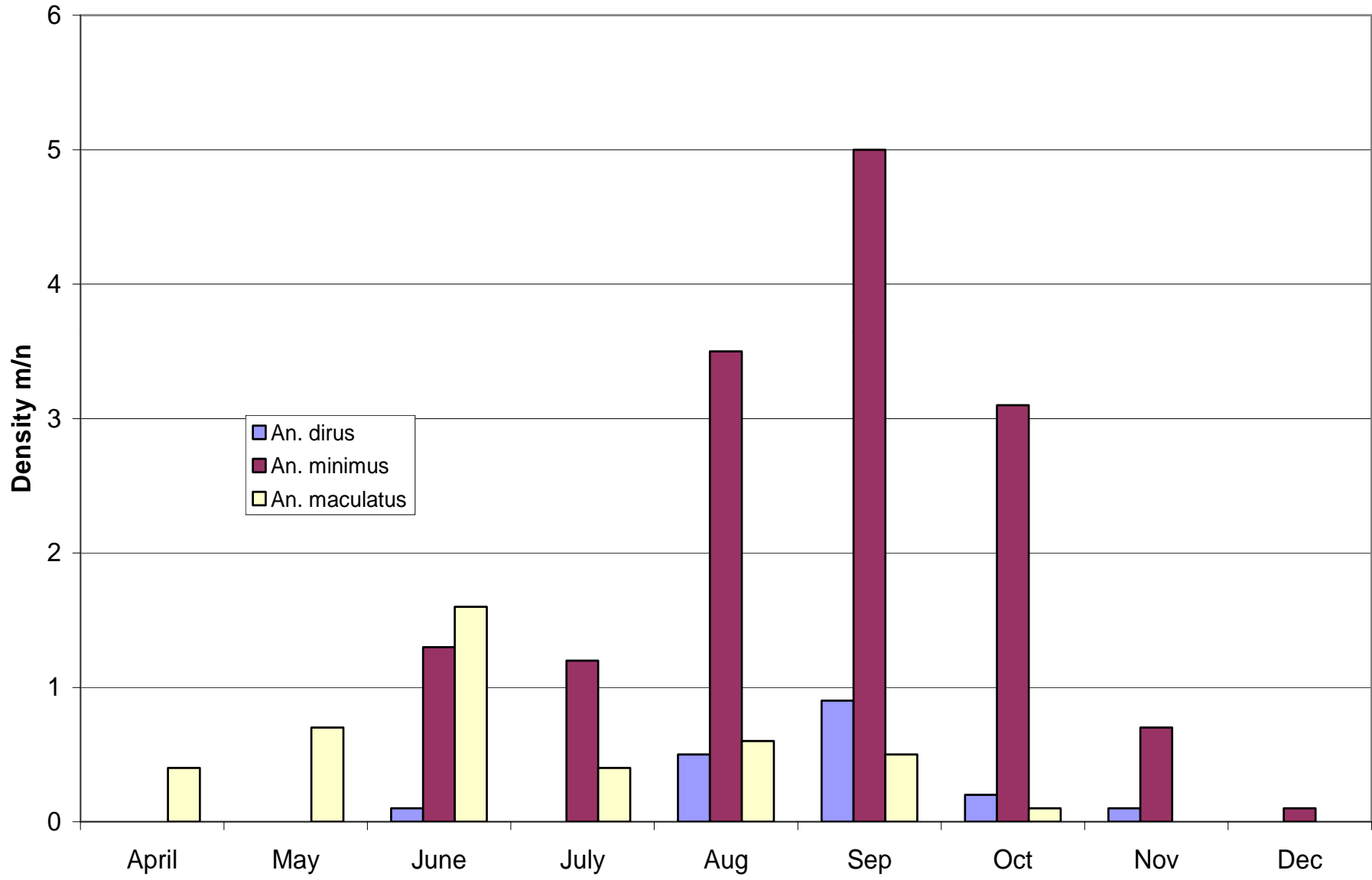
Density of cattle: number of mosquitoes /cattle /night

No	Date	TOTAL			Density m/n		
		OC	OH	IH	OC	OH	IH
1	<i>dirus s.l</i>	4	175	54	0.50	21.88	6.75
2	<i>minimus s.l</i>	0	3	0	0.00	0.38	0.00
3	<i>maculatus s.l</i>	7	45	29	0.88	5.63	3.63

# Total caught mosquitoes in Mondulkiri 2008

No	species	OH	Density OH	IH	Density IH	Ratio OH/IH	Total HLC	Density HLC	OC	Density OC	Ratio HLC/OC
1	An. dirus	16	0.16	1	0.02	8.00	17	0.11	1	0.02	5.67
2	An. minimus	107	1.07	15	0.3	3.57	122	0.81	27	0.54	1.51
3	An. maculatus	37	0.37	6	0.12	3.08	43	0.29	32	0.64	0.45
4	An. kawari	10	0.1	3	0.06	1.67	13	0.09	6	0.12	0.72
5	An. vagus	18	0.18	1	0.02	9.00	19	0.13	260	5.2	0.02
6	An barbirotris	12	0.12	1	0.02	6.00	13	0.09	21	0.42	0.21
7	An.jamasi	22	0.22	2	0.04	5.50	24	0.16	13	0.26	0.62
8	An philippinensis	41	0.41	4	0.08	5.13	45	0.30	17	0.34	0.88
9	An. tesselatus	7	0.07	0	0		7	0.05	3	0.06	0.78
10	An kochi	131	1.31	17	0.34	3.85	148	0.99	9	0.18	5.48
11	An.sinensis	3	0.03	0	0		3	0.02	2	0.04	0.50
<b>TOTAL</b>		<b>404</b>	<b>4.04</b>	<b>50</b>	<b>1</b>	<b>4.04</b>	<b>454</b>	<b>3.03</b>	<b>391</b>	<b>7.82</b>	<b>0.39</b>

**Figure 4: Seasonal fluctuation of An. in Mondulkiri 2008**





## Result ELISA of mosquitoes from Rattanakiri and Modulkiri MD provinces in 2008

Code	MD	RT	Positive N( % ) in MD			Positive N( % ) in RT		
Species			PF	PV210	PV247	PF	PV210	PV247
<i>An.dirus s.l</i>	15	80	1(6.67)	0	0	0	0	0
<i>An.minimus s.l</i>	140	573	0	0	0	0	0	0
<i>An. maculatus s.l</i>	70	584	0	0	0	0	0	0
<b>TOTAL</b>	<b>225</b>	<b>1237</b>	<b>1( 0.44 )</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Method Bio-assay test activity.

WHO tube testing for bio-assay test.

Three types of insecticide impregnated paper: *Deltamethrin 0.05%*, *Permethrin 0.75%*, and *DDT 4%*.

Tests were carried out at the WHO recommendation concentration. The impregnated papers were produced by USM Malaysia ( WHO standard ).

## **Mosquitoes:**

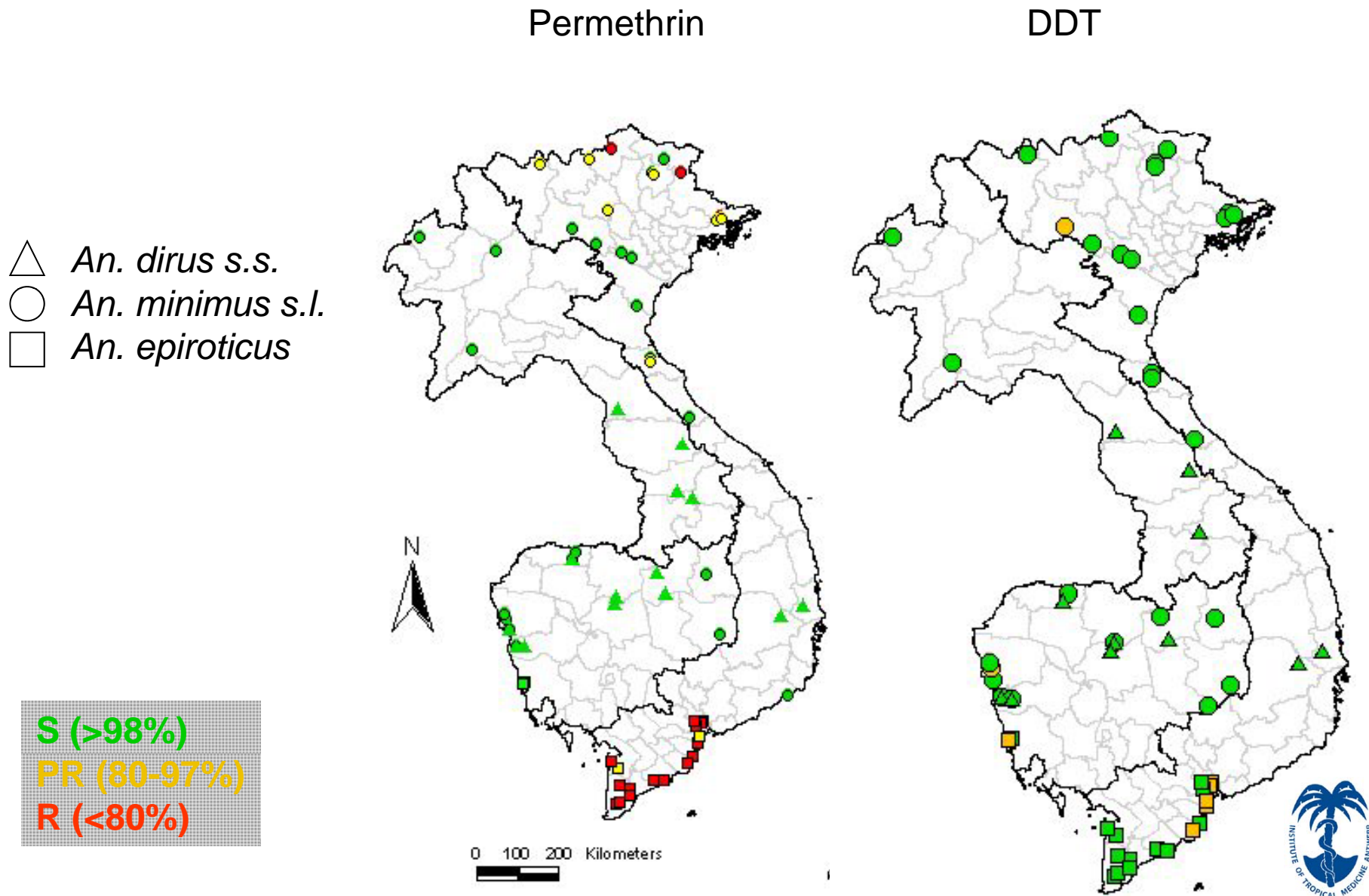
**The main species of female *Anopheles* to be tested:**

***An.dirus, An. minimus, An.sundaicus*  
*and An.vagus* in the fields and in the deferent  
age, physiological state, collection methods  
OH, IH, OC, - Most of mosquitoes collected from  
OH and OC**

**Culture mosquitoes in insectary of CNM**



- Results main malaria vectors



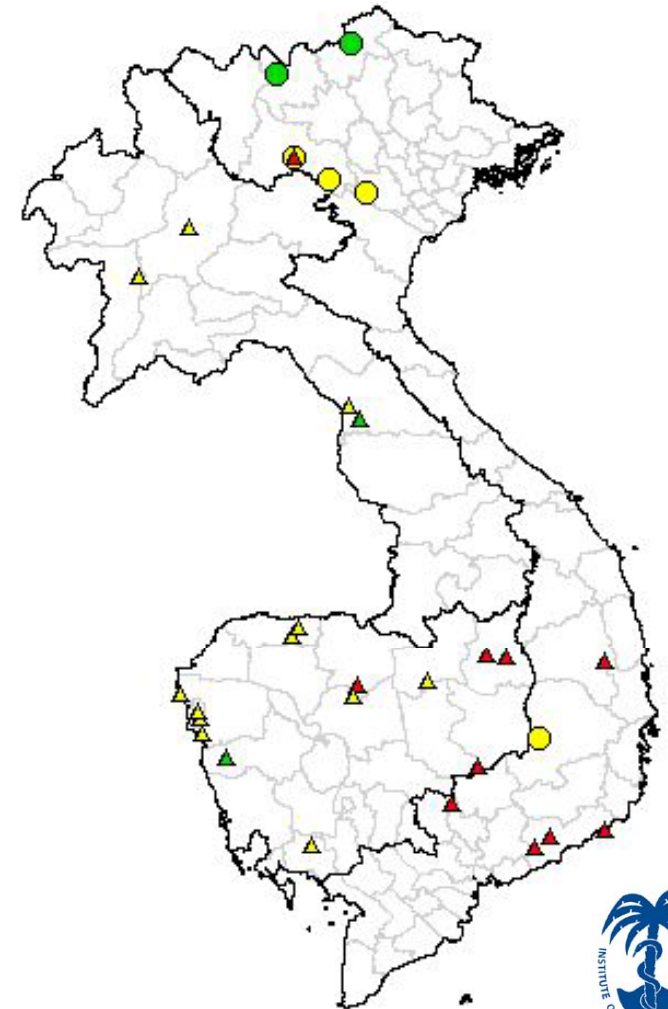
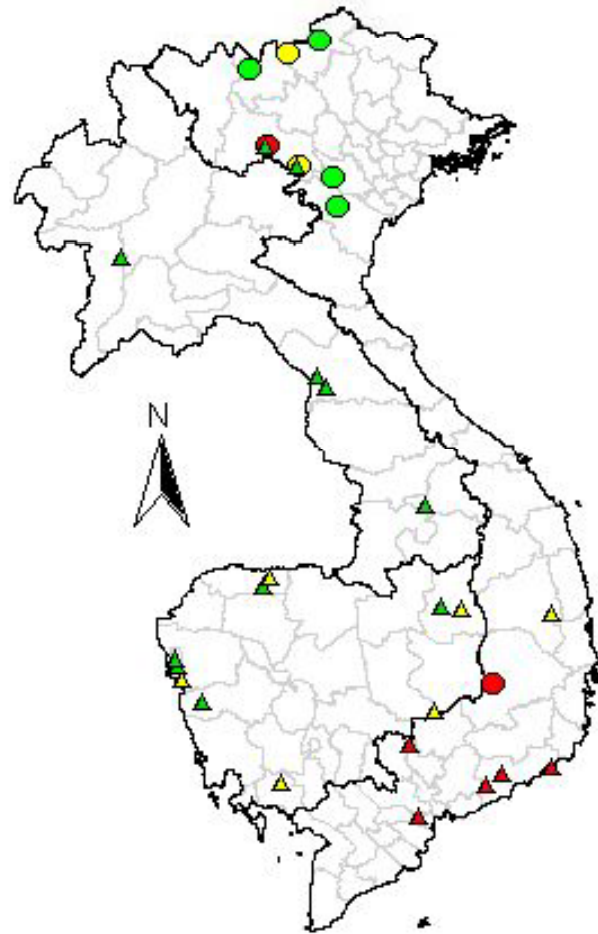
# Results *An. vagus* & *An. sinensis*

## Potential malaria vectors

Permethrin

DDT

- △ *An. vagus*
- *An. sinensis*



S (>98%)  
PR (80-97%)  
R (<80%)

# Results of insecticide resistance done on Anophelines with susceptible test in Rattanakiri (RT) province and Moundulkiri (MD) province , 2008

No	An species	Insecticide	Number of mosquitoes	Number of test	mortality rate% after correction	Remark
1	An. dirus	Deltametrine0.05%	115	6	100	not yet resistance
		<b>DDT 4 %</b>	<b>110</b>	<b>6</b>	<b>98</b>	Need to re confirm
2	An. minimus	Deltametrine0.05%	320	18	99	not yet resistance
		Permethrin 0.75%	120	6	98	Need to re confirm
3	An. maculatus	Deltametrine0.05%	330	15	98	not yet resistance
		Permethrin 0.75%	120	8	98	Need to re confirm
4	An. philippinensis	Permethrin 0.75%	120	6	99	Need to re confirm
		Deltametrine0.05%	220	11	100	not yet resistance
5	An. vagus	<b>DDT4%</b>	<b>600</b>	<b>30</b>	<b>47</b>	Resistance in Rattanakiri and Mondukiry
		Deltametrine0.05%	180	9	97	Possible resistance
<b>TOTAL</b>			<b>2235</b>	<b>115</b>		

## Result of insecticide susceptible test of An. dirus in insectary of CNM

No	An species	Insecticide	Number of mosquitoes	Number of test	mortality rate% after correction	Remark
1	An. dirus	Deltamethrin 0.05%	200	10	100%	Sensitive
		<b>DDT 4 %</b>	<b>200</b>	<b>10</b>	<b>85%</b>	P R
		Permethrin 0.75%	200	10	100%	sensitive
<b>Total</b>			<b>600</b>	<b>30</b>		



Figure 1 : Biting activity of An epiterocus

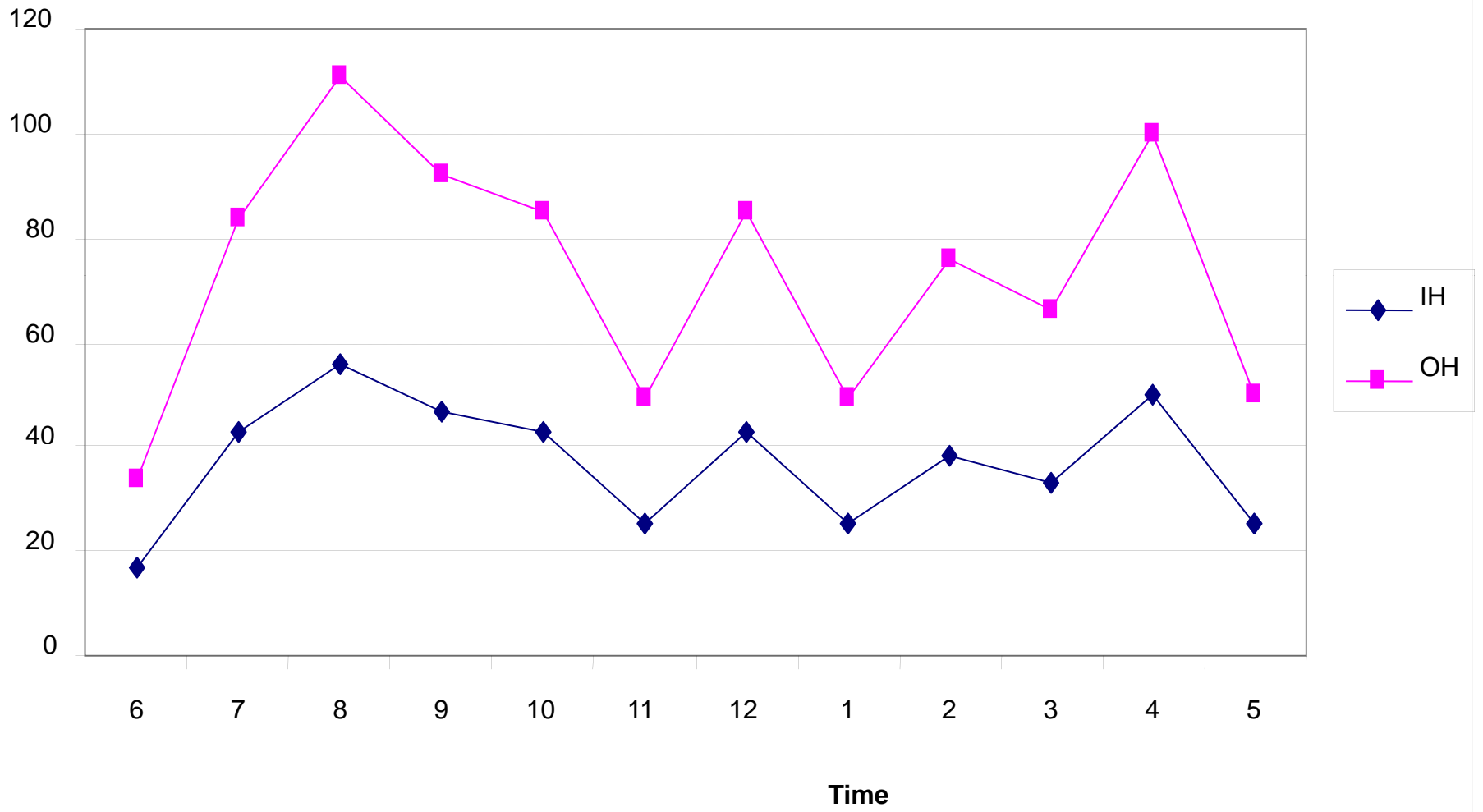
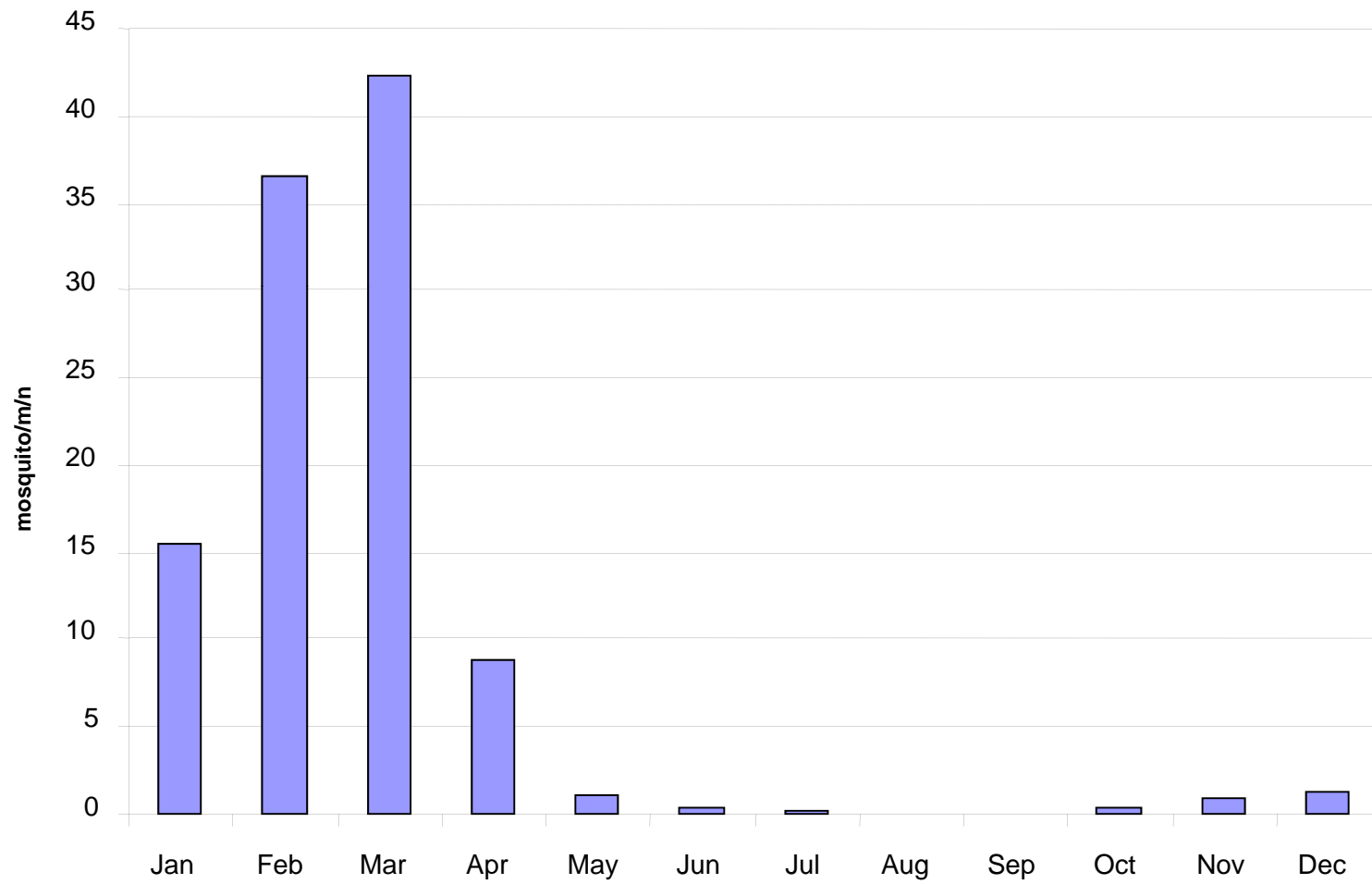


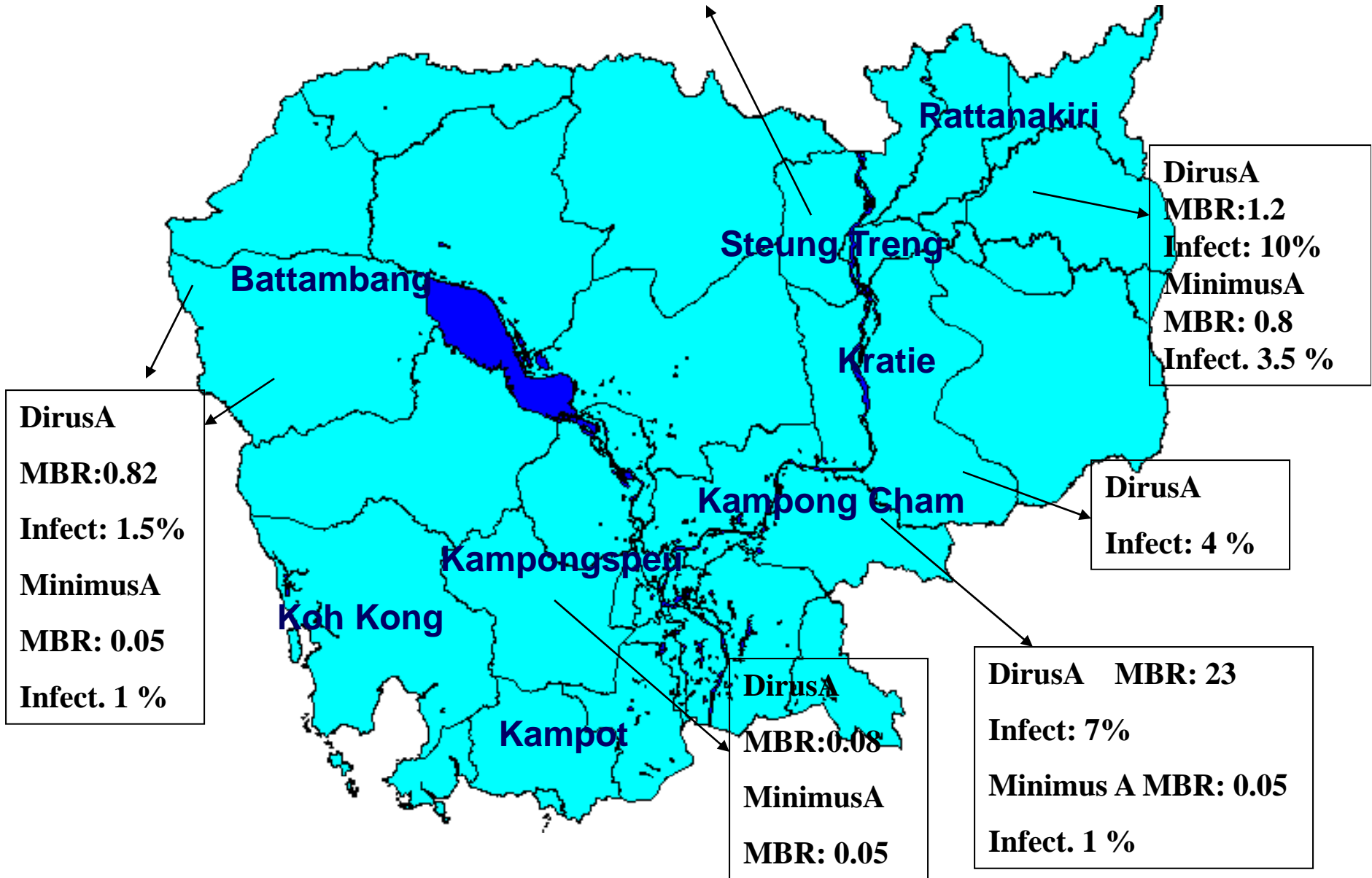
Figure 2: **Density of *An. epiterocus* break down by month**



## Result of insecticide resistance done on *Anophelines* with susceptible test in Koh Kong and Pailin provinces.2009

No	An species	Insecticide	Number of mosquitoes	Number of test	mortality rate% after correction	Remark
1	An. dirus	Permethrin 0.75%	68	5	100	S
2	an.minimus	Deltametrine0.05%	114	6	<b>100</b>	<b>S</b>
		Permethrin 0.75%	189	20	<b>98.6</b>	<b>S</b>
3		<b>DDT 4%</b>	<b>169</b>	<b>12</b>	<b>93.5</b>	<b>PR</b>
	An. Epiterocus	DDT 4%	511	29	96.4	PR
		Permethrin 0.75%	<b>435</b>	23	98.875	S
		Deltamethrin 0.05%	298	<b>16</b>	99.33333	S

**Dirusa MBR:1.1 Infect: 0.8%**  
**Minimusa MBR: 1 Infect. 0.5 %**



**Dirusa**  
**MBR:1.2**  
**Infect: 10%**  
**Minimusa**  
**MBR: 0.8**  
**Infect. 3.5 %**

**Dirusa**  
**MBR:0.82**  
**Infect: 1.5%**  
**Minimusa**  
**MBR: 0.05**  
**Infect. 1 %**

**Dirusa**  
**Infect: 4 %**

**Dirusa**  
**MBR:0.08**  
**Minimusa**  
**MBR: 0.05**

**Dirusa MBR: 23**  
**Infect: 7%**  
**Minimus A MBR: 0.05**  
**Infect. 1 %**

**THANKS FOR YOUR ATTENTION**

