Acknowledgement

Asia Pacific Malaria Elimination Network (APMEN)

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Introduction

Human landing collection (HLC) is considered as the gold standard for indoor and outdoor collections.

However, HLC is a labor-intensive procedure requiring highly trained collectors and extensive supervision, and is unsustainable for large-scale operational sampling of malaria vectors.

Using humans and animals as the mosquito bait has recently been seriously restricted because of ethical reasons from the public.




Objective

Compare three outdoor trapping methods; human decoy trap (HDT) and human double net trap (HDNT) with an outdoor human landing collection (OHLC).

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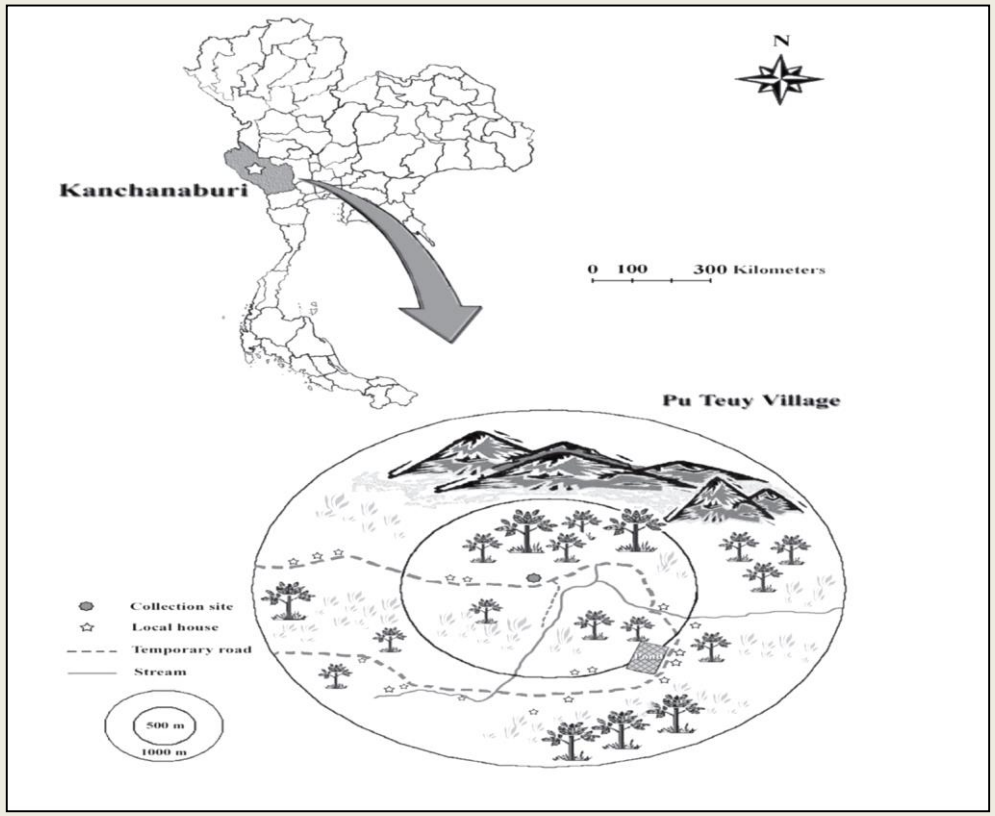
The primary objective

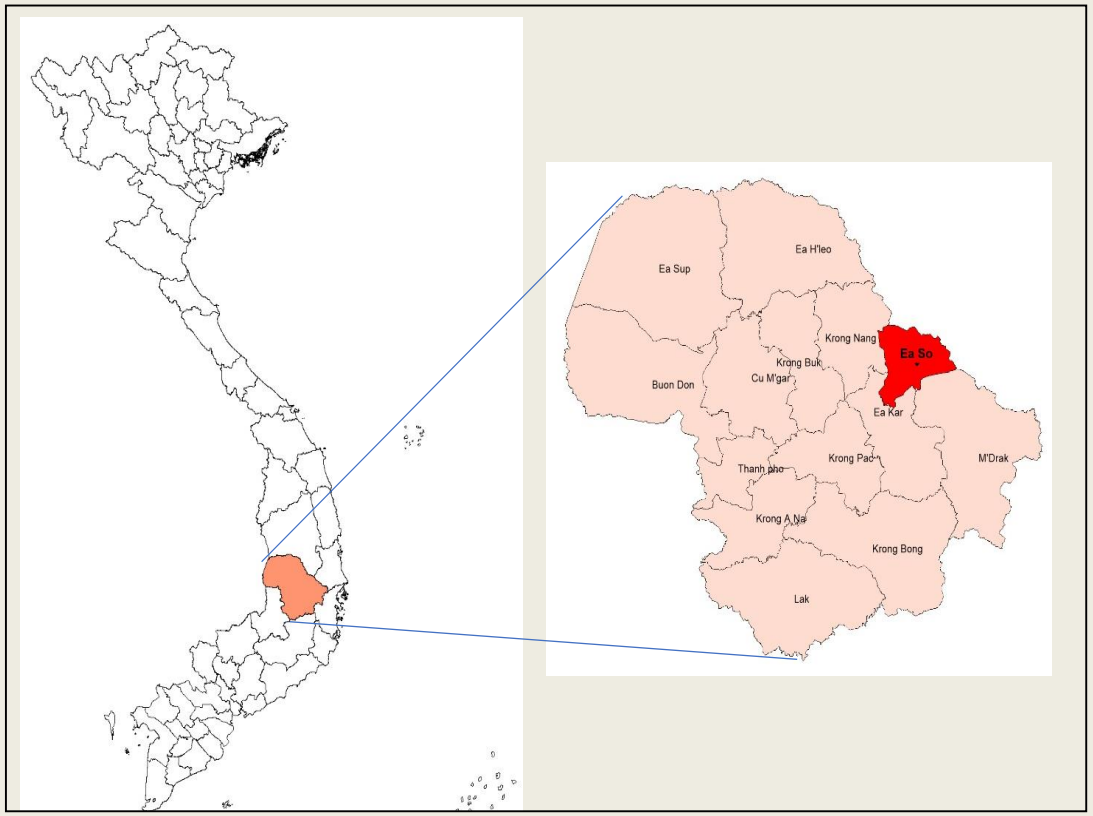
was to determine the two outdoor trap efficacies (HDNT, HDT) in terms of *Anopheles* per night per trap in comparison with the ‘gold standard’ human landing collection

Study Areas

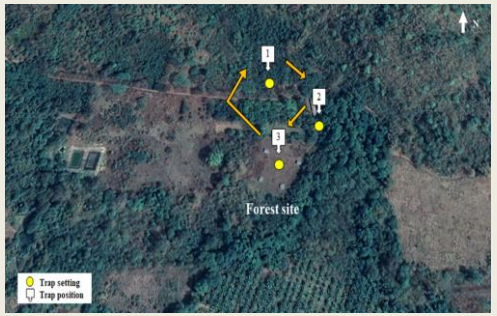
Thailand: The study was conducted at Pu Toey Village, Sai Yok District, Kanchanaburi Province (14° 17'N, 99° 1'E),

Vietnam: The study was conducted at Easo commune, Eakar District, Dak Lak Province (12,97° N, 108,60° E), approximately 1200 km from Hanoi.

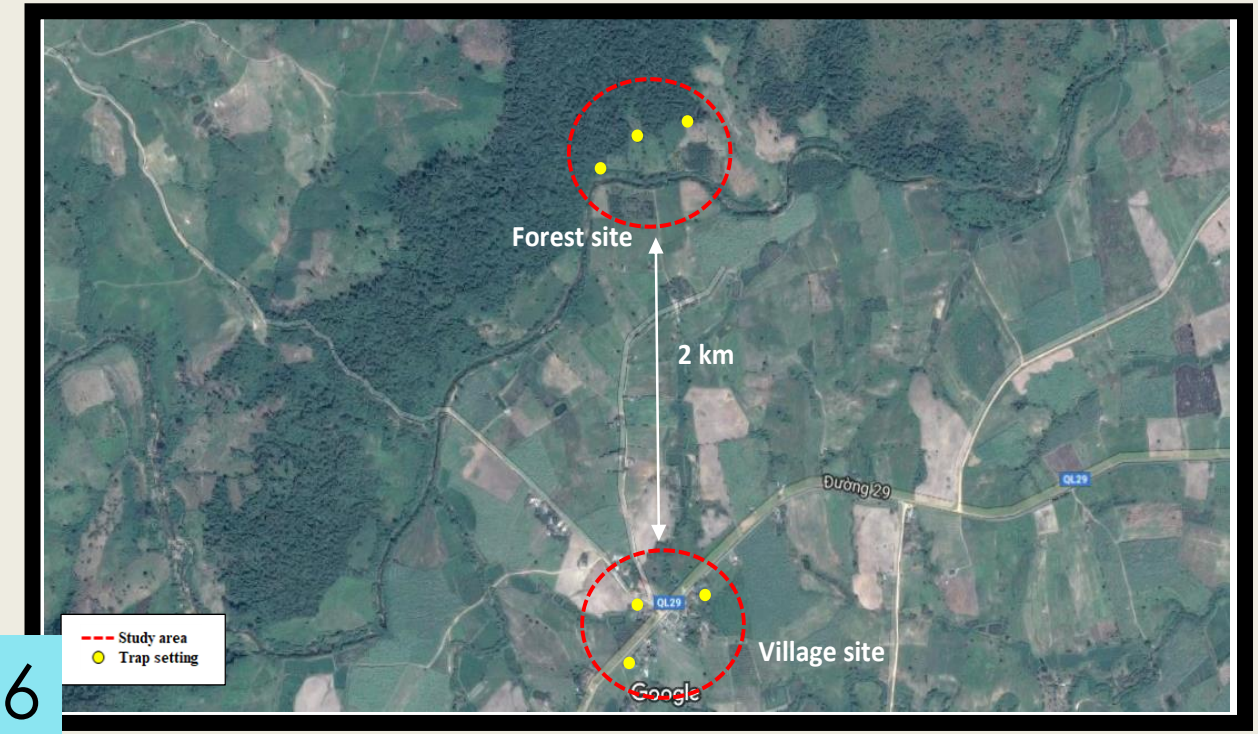




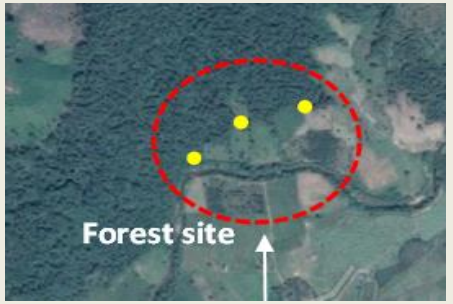
THAILAND
Forest vs. Village



Three local spots were selected at each site and the distance between each spot was 100 meter apart.



Vietnam
Forest vs. Village



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HUMAN DECOY TRAP

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HUMAN DOUBLE NET TRAP

HUMAN LANDING COLLECTION

Inner net size = 1.2 x1.8 x 1.8 m (width x length x height)

Outer net size = 2.2 x 2.8 x 1.5 (width x length x height)

	Human Double Net Trap	Outdoor Human Landing Catch
Time	1800-0600	1800-0600
Human host	Host 1(1800-0000)	Host 1(1800-0000)
	Host 2(0000-0600)	Host 1(1800-0000)
Host location	Inside net	Outdoor
Period of collection	every 15	45 min
Time break	15 min each hour	15 min each hour
Collector	Host	Host

Human Decoy Trap
1.Study time: 1800-0600 hrs 2.One human host sleeps inside a tent for the entire night 3.Hot water-sticky plastic film to trap mosquitoes 4.Tent: 2 m length x 1.5 m width x 1.5 m height 5.Collect specimens at 0600 hr.

Replicate	Night	Location 1	Location 2	Location 3
1	Night1	OHLC+ Host A (A1, A2)	HDNT+ Host B (B1, B2)	HDT+ Host C
1	Night2	HDT+ Host C	OHLC+ Host A (A1, A2)	HDNT+ Host B (B1, B2)
1	Night3	HDNT+ Host B (B1, B2)	HDT+ Host C	OHLC+ Host A (A1, A2)
	BREAK			
2	Night4	OHLC+ host A (A1, A2)	HDNT+ host B (B1, B2)	HDT+ host C
2	Night5	HDT+ host C	OHLC+ host A (A1, A2)	HDNT+ host B (B1, B2)
2	Night6	HDNT+ host B (B1, B2)	HDT+ host C	OHLC+ host A (A1, A2)
	BREAK			
3	Night7	OHLC+ host A (A1, A2)	HDNT+ host B (B1, B2)	HDT+ host C
3	Night8	HDT+ host C	OHLC+ host A (A1, A2)	HDNT+ host B (B1, B2)
3	Night9	HDNT+ host B (B1, B2)	HDT+ host C	OHLC+ host A (A1, A2)
	BREAK			
4	Night10	OHLC+ host A (A1, A2)	HDNT+ host B (B1, B2)	HDT+ host C
4	Night11	HDT+ host C	OHLC+ host A (A1, A2)	HDNT+ host B (B1, B2)
4	Night12	HDNT+ host B (B1, B2)	HDT+ host C	OHLC+ host A (A1, A2)
	BREAK			
5	Night13	OHLC+ host A (A1, A2)	HDNT+ host B (B1, B2)	HDT+ host C
5	Night14	HDT+ host C	OHLC+ host A (A1, A2)	HDNT+ host B (B1, B2)
5	Night15	HDNT+ host B (B1, B2)	HDT+ host C	OHLC+ host A (A1, A2)
	BREAK			
6	Night16	OHLC+ host A (A1, A2)	HDNT+ host B (B1, B2)	HDT+ host C
6	Night17	HDT+ host C	OHLC+ host A (A1, A2)	HDNT+ host B (B1, B2)
6	Night18	HDNT+ host B (B1, B2)	HDT+ host C	OHLC+ host A (A1, A2)

3x3 Latin square design study was used to compare the three traps in the two study sites for each country.

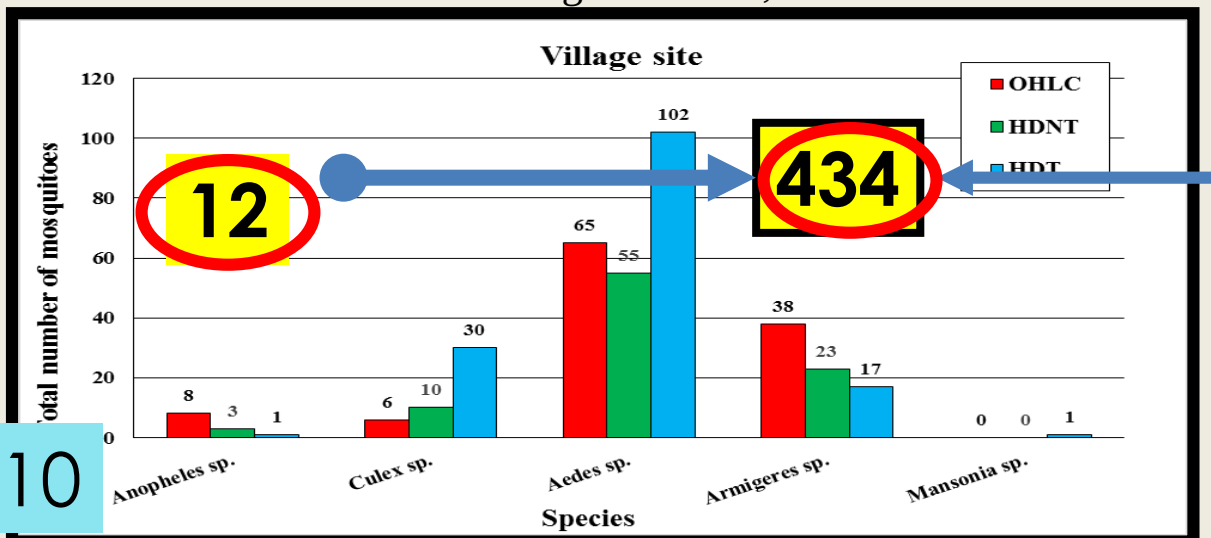
At each site, six replicates were performed, comprising 18 collection nights (3 nights represent one replicates).

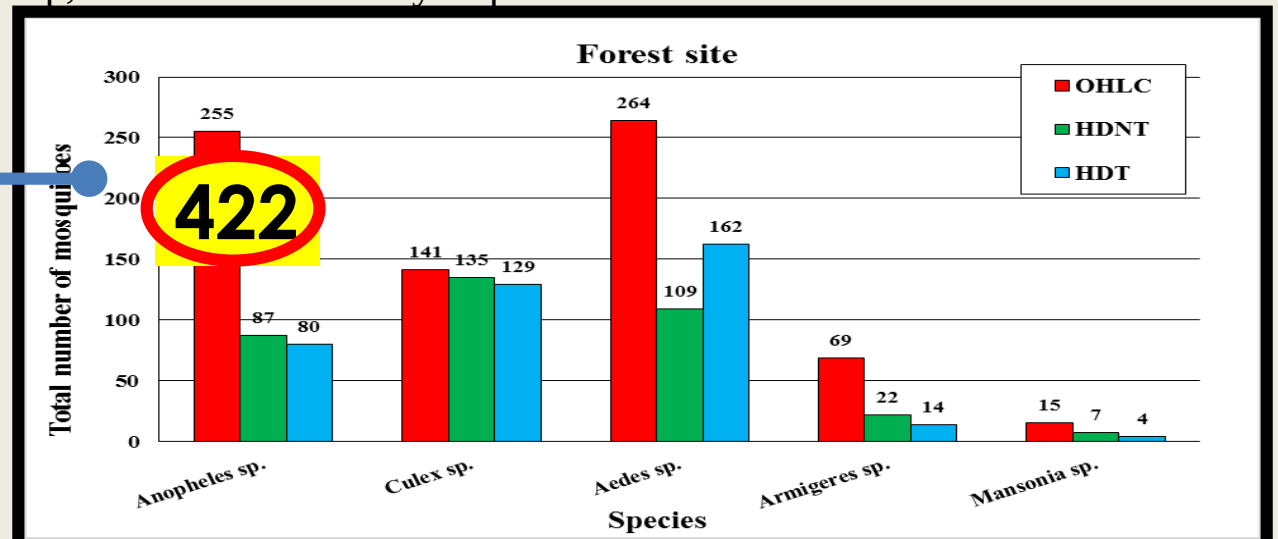
A1:A2- two hosts for OHLC
B1: B2- two hosts in HDNT
C - A host in HDT

Total number of mosquitoes collected by genus from three traps at two sites in Thailand

Species/Trap	Village			Forest			Total
	OHLC	HDNT	HDT	OHLC	HDNT	HDT	
Anopheles spp	8	3	1	255	87	80	434
Culex spp.	6	10	30	141	135	129	451
Aedes spp.	65	55	102	264	109	162	757
Armigeres spp.	38	23	17	69	22	14	183
Mansonia spp.	0	0	1	15	7	4	27
Total	117	91	151	744	360	389	1852

OHCL: Outdoor human landing collection, HDNT: Human double net trap, HDT: Human decoy trap





Total number of *Anopheles** collected from three traps at two sites in Thailand

Species/Trap	Village			Forest			Total
	OHLC	HDNT	HDT	OHLC	HDNT	HDT	
An. minimus	1	0	0	4	4	1	10
An. harrisoni	6	1	0	250	80	72	409
An. maculatus	1	1	0	0	0	1	3
An. dirus	0	1	0	0	0	1	2
An. barbirostris	0	0	0	0	1	0	1
Anopheles spp**	0	0	1	1	2	5	9
Total	8	3	1	255	87	80	434

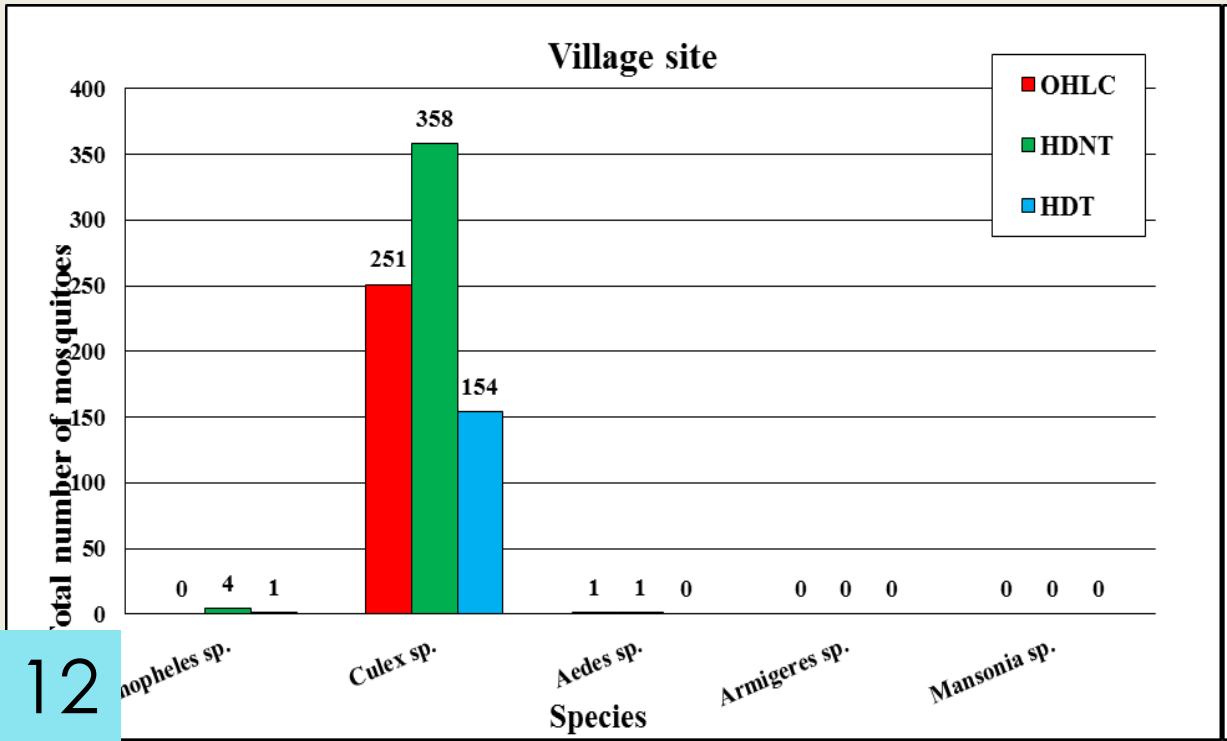
OHCL: Outdoor human landing collection, HDNT: Human double net trap, HDT: Human decoy trap

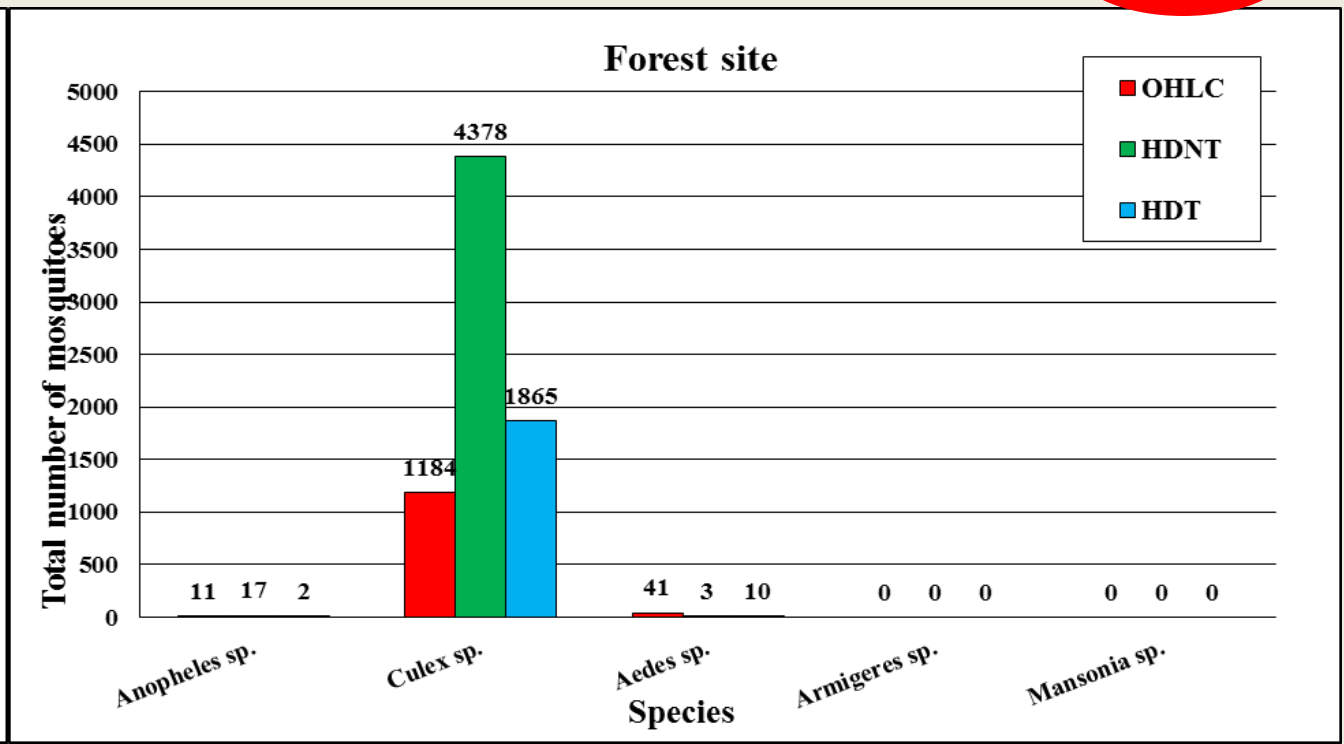
* **Molecular Identification**

** **Broken samples**

Total number of mosquitoes collected by genus from three traps in two sites in Vietnam

Species/Trap	Village			Forest			Total
	OHLC	HDNT	HDT	OHLC	HDNT	HDT	
Anopheles spp	0	4	1	11	17	2	35
Culex spp.	251	358	154	1184	4378	1865	8190
Aedes spp.	1	1	0	41	3	10	56
Total	252	363	155	1236	4398	1877	8281





Total number of *Anopheles* collected from three traps at two sites in Vietnam

Species/Trap	Village			Forest			Total
	OHLC	HDNT	HDT	OHLC	HDNT	HDT	
An. aconitus	0	1	0	0	0	0	1
An. sawadwongporni	0	0	0	3	1	1	5
An. dirus	0	0	0	5	4	0	9
An. wejchoochotei	0	0	1	1	1	1	4
An. sinensis	0	3	0	1	6	0	10
An. peditaeniatus	0	0	0	1	3	0	4
An. tessellatus	0	0	0	0	1	0	1
An. vagus	0	0	0	0	1	0	1
Total	0	4	1	11	17	2	35

OHCL: Outdoor human landing collection, HDNT: Human double net trap, HDT: Human decoy trap

21

3

Village habitat: total number of Anopheles mosquitoes collected from 3 traps

	Thailand	Vietnam	TOTAL
Outdoor Human Landing	8	0	8
Human Double Net Trap	3	4	7
Human Decoy Trap	1	1	2
TOTAL	12	5	17

Forest habitat: total number of Anopheles mosquitoes collected from 3 traps

	Thailand	Vietnam	TOTAL
Outdoor Human Landing	255	11	236
Human Double Net Trap	87	17	104
Human Decoy Trap	80	2	82
TOTAL	422	30	422

Comparison of mean number of collected mosquitoes/trap/night among 3 traps from 2 sites in Thailand

	Trap	N	Mean± SE (minimum–maximum)	
			Forest site	Village site
Anopheline	**OHLC**	18	2.18±0.29 (0.00–3.80) [a]	0.48±0.18 (0.00–2.20) [a]
	HDNT	18	1.19±0.25 (0.00–3.50) [b]	0.42±0.20 (0.00–2.40) [a]
	HDT	18	1.14±0.25 (0.00–2.90) [b]	0.42±0.23 (0.00–3.14) [a]
Total mosquitoes	**OHLC**	18	3.58±0.15 (2.40–4.50) [a]	1.63±0.21 (0.00–0.21) [a]
	HDNT	18	2.50±0.29 (0.00–4.20) [b]	0.95±0.23 (0.00–3.20) [a]
	HDT	18	2.97±0.13 (1.80–3.90) [b]	1.49±0.25 (0.00–3.40) [a]

Same letters indicate no significant difference (95%) (within block)

Comparison of mean number of collected mosquitoes/trap/night among 3 traps from 2 sites in Vietnam

Family	Trap	N	Mean± SE (minimum–maximum)	
			Forest site	Village site
Anopheline	**OHLC**	15	0.73± 0.23 (0.00-2.00) [a]	0.00±0.00 (0.00-0.00) [a]
	HDNT	15	1.13±0.62 (0.00-9.00) [a]	0.33±0.13 (0.00-100) [b]
	HDT	15	0.20±0.11 (0.00-1.00) [b]	0.07±0.07 (0.00-1.00) [a]
Total mosquitoes	**OHLC**	15	82.40±19.51 (4.00-310.00) [a]	16.80±3.37 (2.00-53.00) [a]
	HDNT	15	293.20±47.59 (128.00-828.00) [b]	24.27±5.28 (3.00-78.00) [a]
	HDT	15	125.20±23.37 (32.00-302.00) [a]	10.33±2.73 (1.00-44.00) [a]

Same letters indicate no significant difference (95%) (within block)

Conclusion

Thailand:

Largest number of *Anopheles* was collected from **Outdoor Human Landing Collection (60.6%** of total collected *Anopheles*), followed by **Human Double Net Trap (20.7%** of the total collected *Anopheles*) and **Human Decoy Trap (18.6%** of the total collected *Anopheles)*.

However, there were no significant differences in mean number of Anopheles mosquitoes between **human double net trap vs. human decoy trap** in forest or in village.

HDNT and HDT can be used for large scale outdoor malaria vector surveillance and monitoring when it is difficult to use human landing catch in forest setting in Thailand

Conclusion (cont.)

Vietnam:

The Human **Double Net Trap** was found the most effective to capture the Anopheles mosquitoes (60%) when compared with **Outdoor Human Landing Collection (32%)** and **Human Decoy Trap (8%)** in both collection sites.

However, there were significant differences in mean number of Anopheles mosquitoes collected between human double net trap and human decoy trap.

As extremely few Anopheles were collected, analysis on comparing the three trapping methods in Vietnam may be not precisely appropriated.

Recommendation

1.Field trial with three trap devices should be performed in **different seasons**, **hot, rain, and dry** to observe more details from different species of malaria vectors as well as the overall trap efficacy.

2.Forest setting should be considered to be the main site for evaluation the trap efficacy as most malaria vectors in GMS countires occupy the forest habitats.

3.To increase the strength of data, more field sites from other GMS countries should be assigned.

THANK YOU

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