Efficacy of guppies, community engagement, and pyriproxyfen on dengue vectors in Cambodia: a cluster randomized trial

John Hustedt

JITMM 2015

Dengue

- 3.6 billion at risk with 390 million infections each year of which 96 million are symptomatic (70% in Asia)
- In Cambodia there were 13,018 reported cases (35 Deaths) through week 40 this year
- No vaccine or therapeutic treatment, so prevention relies on vector control

Vector Control in Cambodia

Challenges

- Reliance on temephos, which is now resistant in most provinces tested[1], and *Bacillus thuringiensis* israelensis (Bti)
- Little evidence available for effectiveness and acceptability of other vector control methods for *Aedes* in Cambodia

Opportunities

- Demonstrate the impact of a combination of previously proven & new vector control tools to sustainably reduce *Aedes* populations and thus reduce dengue transmission

[1] (Polson et al. 2001, Khun et al. 2007)

Container Surveys in Kampong Cham, Cambodia

Container Type	Baseline (297)		Baseline (251)	
	No.	Pupae	No.	Pupae
Drum	120	148	173	247
Concrete water jar	896	9,804	595	7,496
Concrete tank	162	692	73	550
Small pot	165	284	123	490
Flower vase	51	29	76	24
Tires	79	251	75	158
Tin can	189	129	47	2
Broken pot	283	72	121	12
Other	293	290	191	127
Total	**2,238**	**11,699**	**1,474**	**9,106**

Pupal biomass:

Water jars, drums, and concrete tanks (>50L) ≈90%

Small containers (<50L): ≈10%
8293

Source: Chang et al. 2008

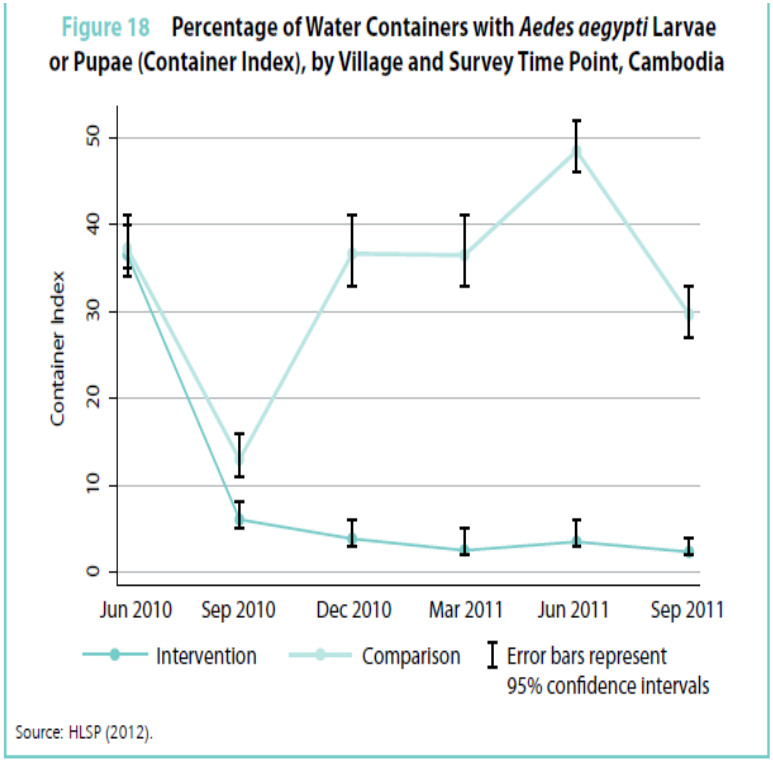
Interventions

Vector control tools:

- Larvivorous fish (Guppies) (>50 L)
- Slow-release juvenile hormone analogue (Pyriproxyfen) (<50L)
- Communication for Behavioral Impact (COMBI)

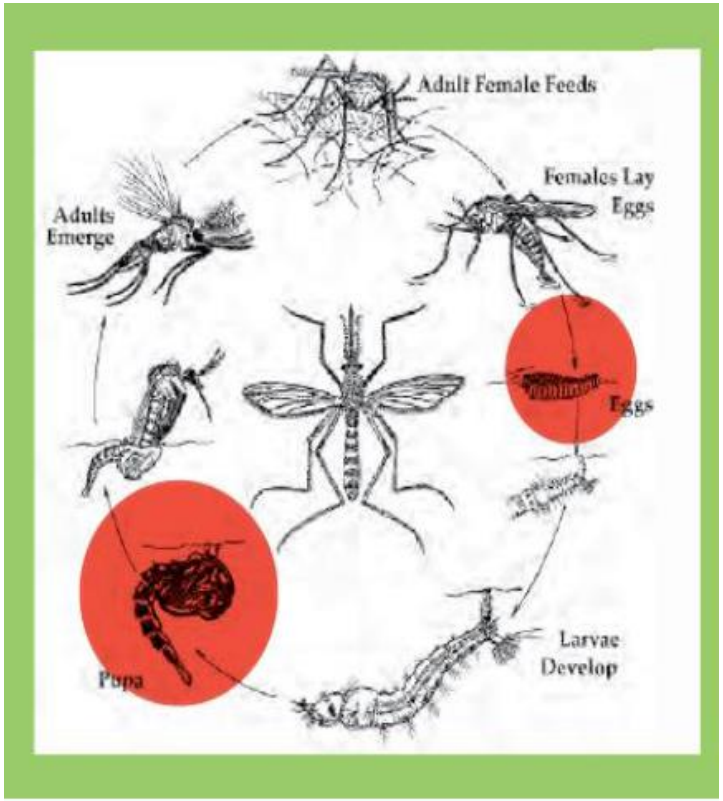
Vector Control

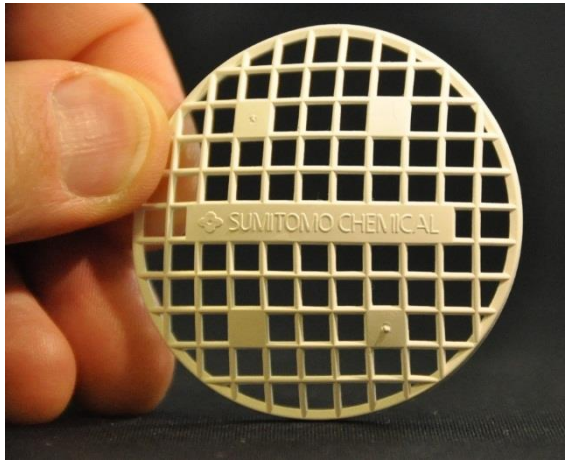
Guppy Fish



Source: WHO, 2013

Pyriproxyfen – Sumilarv© 2MR





Container capacity, L	# MR chips
10	1/5
20	1/2
30	2/3
40	1
50	1

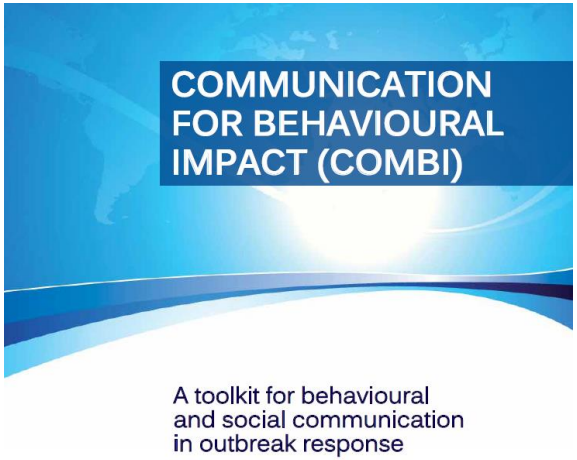
Source: Sumitomo

Pyriproxyfen – Sumilarv© 2MR

Untreated

Treated

Communication for Behavioral Impact



Provides a social mobilization and communication approach that:

Connects knowledge and behaviour

Addresses the cost and value of engaging in healthy behaviours

Recognizes the gradual stages of behaviour change

Creates a supportive environment for behaviour change

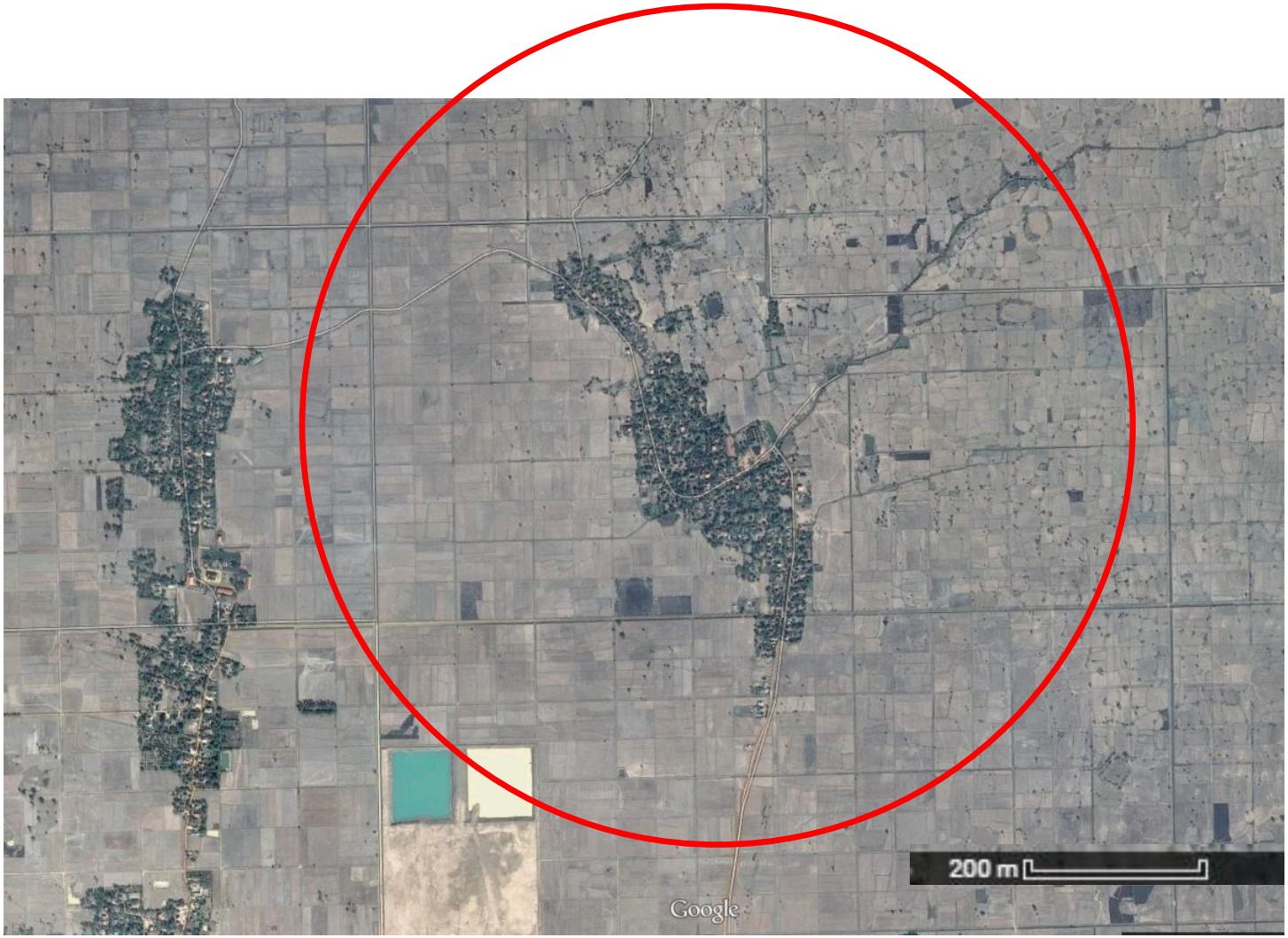
Cluster Randomized Trial

The trial will aim to evaluate the efficacy of three interventions over 12 months (October 2015-September 2016) and will have three arms:

1. Guppies + PPF resin matrix + COMBI
2. Guppies + COMBI
3. Control

Each arm will have 10 clusters of approximately 300-500 HHs

Site Selection – Kampong Cham



Data Collection

- Entomology Survey (Every 4 months)
  - Adult Mosquito Collection
  - Larvae and Pupae Collection
  - Container Survey
  - Premise Condition Index
- Knowledge, Attitudes, and Practice Survey (Baseline & Endline)
- Acceptability Survey (Endline)
- Adult Emergence Inhibition Assays
- CHW monthly monitoring (coverage)

Outcome Measures

Primary Outcome Measure:

Density of resting adult female *Aedes agypti* in the household as measured by entomology surveys at BL,4,8,12 months after start of intervention

Secondary Outcome Measures:

- House index
- Container index
- Breteau index
- Pupae per house
- Pupae per person
- Percentage of indoor resting mosquitos positive for dengue virus

Future

- Assess acceptability and cost-effectiveness to make solid policy recommendations
- Share results among the scientific community, local communities, and government stakeholders
- If mosquito densities plateau above zero consider possible additional interventions available in the future (auto-dissemination traps, vaccines, or genetic control of mosquitoes)

Acknowledgements

World Health Organization

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

SUMITOMO CHEMICAL

កិច្ចសហប្រតិបត្តិការ
អាល្លឺម៉ង់
DEUTSCHE ZUSAMMENARBEIT

អនុវត្តដោយ:
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

UKaid
from the British people

Thank you

malaria consortium
disease control, better health

www.malariaconsortium.org

Jar Covers

Jar Covers

Long lasting insecticidal water container covers

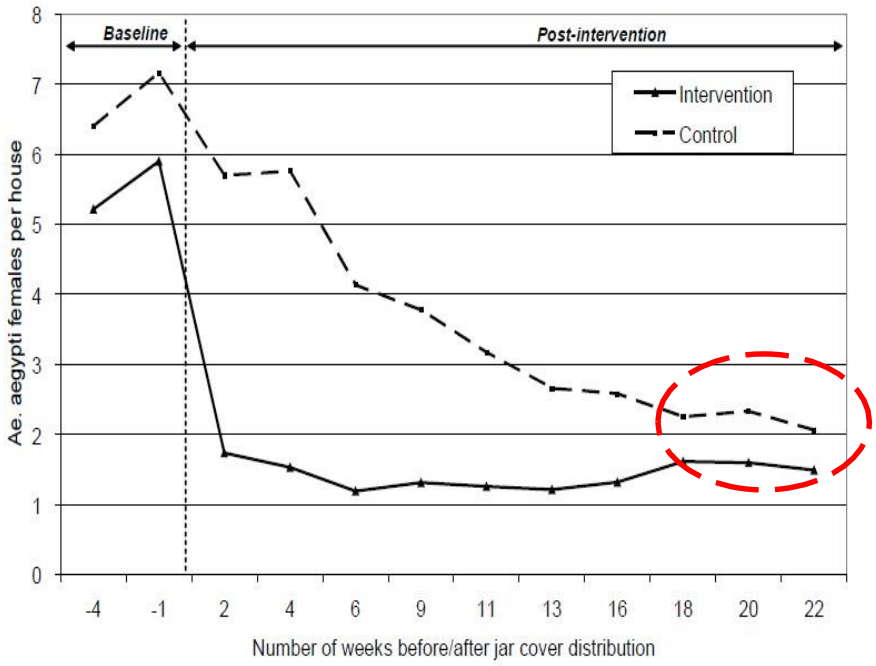
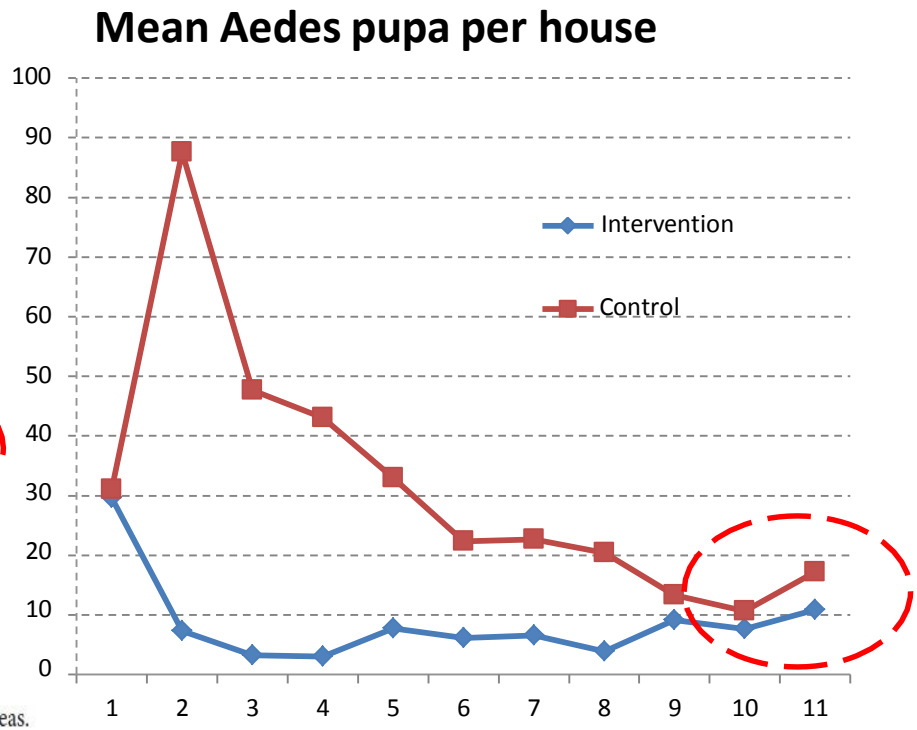


Figure 1. Mean number of indoor resting female *Ae. aegypti* per house in the intervention and control areas.



Chang et al. 2008

Jar Covers

- Despite correct high utilization rates (88%), cost of $1.20 is prohibitive to most rural Cambodians
- Container cover not 100% insect-proof due to incorrect closure allowing mosquito entry and exit
- Harsh outdoor tropical environment degrade fabric & netting of water jar covers; more improvements are needed
- Potential insecticide resistance development → safe alternatives to pyrethroids
- What is the strategy for the “last mile”?

CRT Sample size

		Cambodia					
		Jun 2010	Sep 2010	Dec 2010	Mar 2011	Jun 2011	Sep 2011
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Intervention	Ae aegypti female per house	2.47 (3.13)	0.11 (0.72)	0.28 (0.93)	0.24 (0.83)	0.22 (0.54)	0.16 (0.85)
	Ae aegypti female per person	0.68 (1.08)	0.02 (0.13)	0.09 (0.41)	0.06 (0.23)	0.06 (0.18)	0.05 (0.32)
Control	Ae aegypti female per person	0.33 (0.73)	0.05 (0.24)	0.17 (0.36)	0.30 (0.77)	0.29 (0.70)	0.12 (0.25)
	Ae aeg ypti female per house	1.26 (2.57)	0.17 (0.56)	0.64 (1.15)	1.12 (2.19)	1.10 (2.30)	0.44 (0.84)