International Seminar on Integrated

WATER-Related Disease Control

12-14 May 2014, Norway

Sorhellinga Building
Norwegian University of Life Sciences, Ås

Reducing diarrhea in children and controlling dengue vector *Aedes aegypti* in rural schools in two municipalities in Colombia

Healthy Schools: Project Results

ENTOMOLOGY

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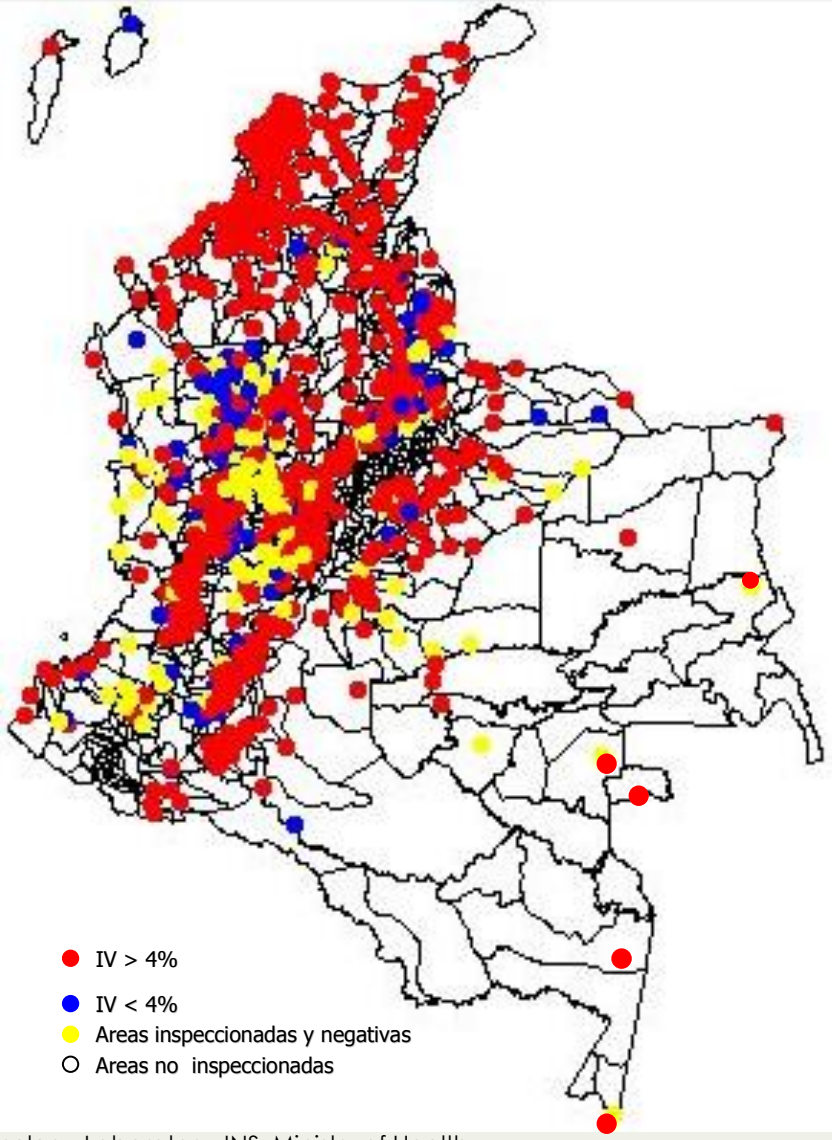
Introduction

Distribution of *Aedes aegypti* in Colombia - 2010



Source: Morales A. Laboratorio de Entomología, INS

Source: Entomology Departmental Units. Entomology Laboratory, INS, Ministry of Health.
Jairo Méndez. Virology Laboratory-INS.

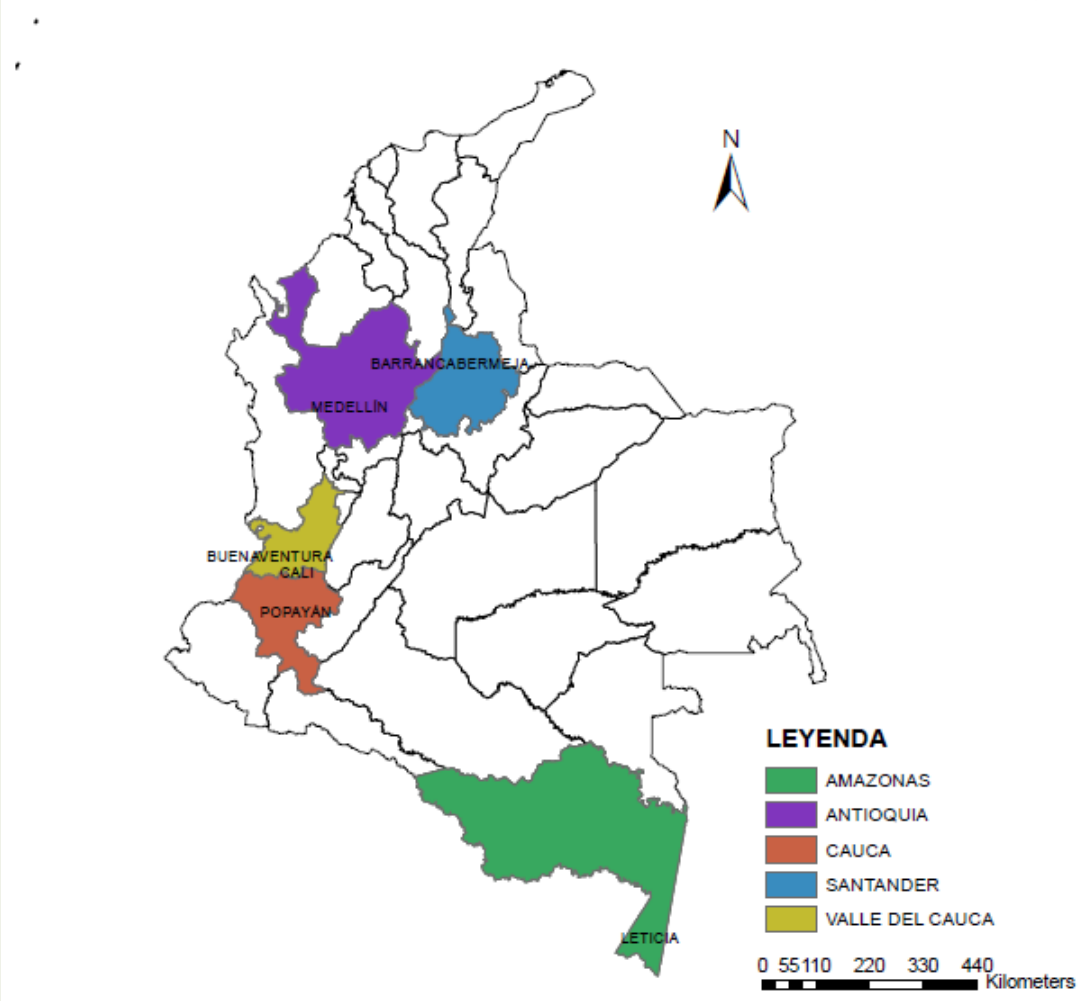
Aedes aegypti in rural area of Colombia

Vereda Santa Barbara, municipality of La Mesa (Cundinamarca), first record in the country of *Aedes aegypti* in rural area(1)

(1) Morales A. *Aedes aegypti* en zona rural del municipio de La Mesa (Cundinamarca) Colombia. Biomédica 1981:1:223-4

Vereda Santa Bárbara, municipio de La Mesa (Cundinamarca), primer registro en el país de *Aedes aegypti* en área rural (1)

Distribution of *Aedes albopictus* in Colombia 2011



Dengue Vector Surveillance Entomological Indices

INMATURE	ADULTS
House Index (%)	Adult Index (%)
Container Index (%)	**Density of adult female *Ae. aegypti***
Breteau Index	
Pupae per Person Index	

Objectives

Reduce exposure to dengue risk factors in schools by:

- Reducing mosquito entry to school classrooms by insecticide-treated curtains
- Reducing dengue mosquito vector breeding through source reduction and larval control

Outcomes

- **Primary outcome:** Density of adult female *Ae. aegypti* in each school (number of females collected per time unit).

- **Secondary outcome**: Breteau index (number of containers with *Ae. aegypti* immatures/100 schools.

Methodology

Inspection of potential *Aedes aegypti* Breeding Sites

Collection and Package of Immature

Aedes aegypti Adults Capture

Adult Forms Package

Identification in Laboratory

Interventions

Interventions

Interventions

Interventions

CDC Methodology

WHO Cone Bioassay Protocol

Interventions' Follow - Up

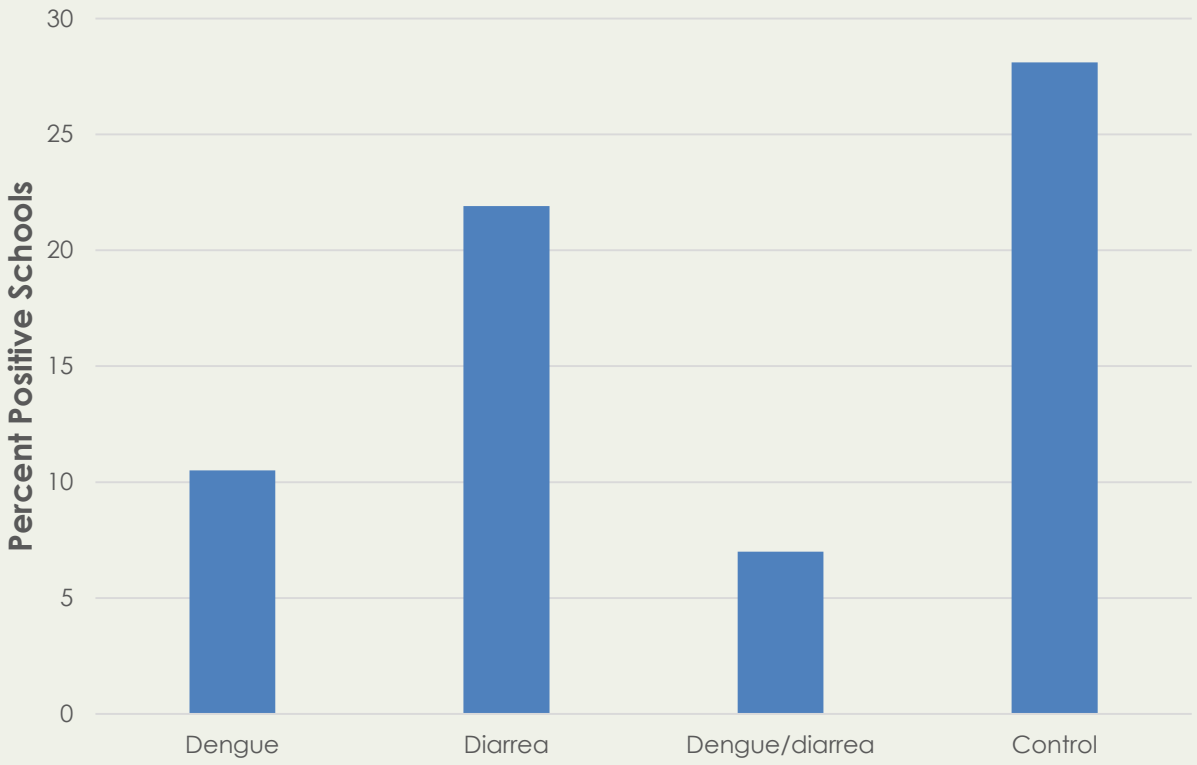
- First follow - up May-June/2012
- Second follow -up October - November/2012
- Third follow - up May-June/2013
- Fourth follow – up October - November/2013

Results

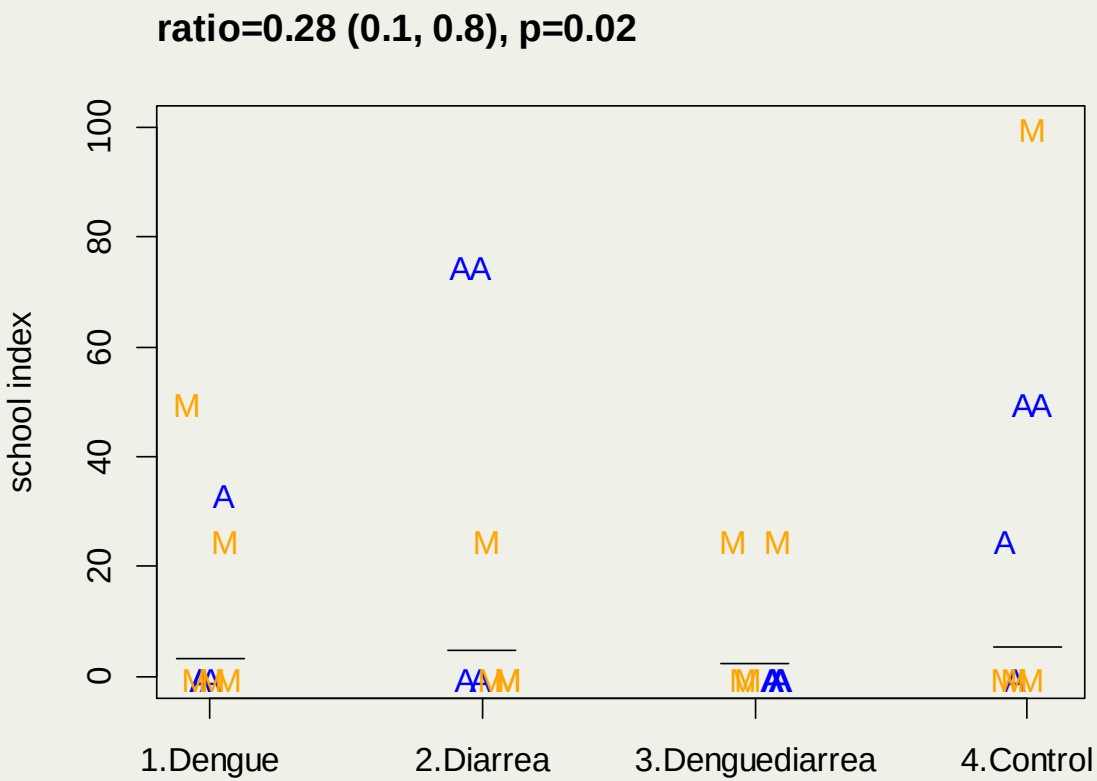
Aedes aegypti Breeding Sites Anapoima-La Mesa Rural Schools 2012-2013

Aedes aegypti Breeding Sites Anapoima-La Mesa Rural Schools 2012-2013

School Index

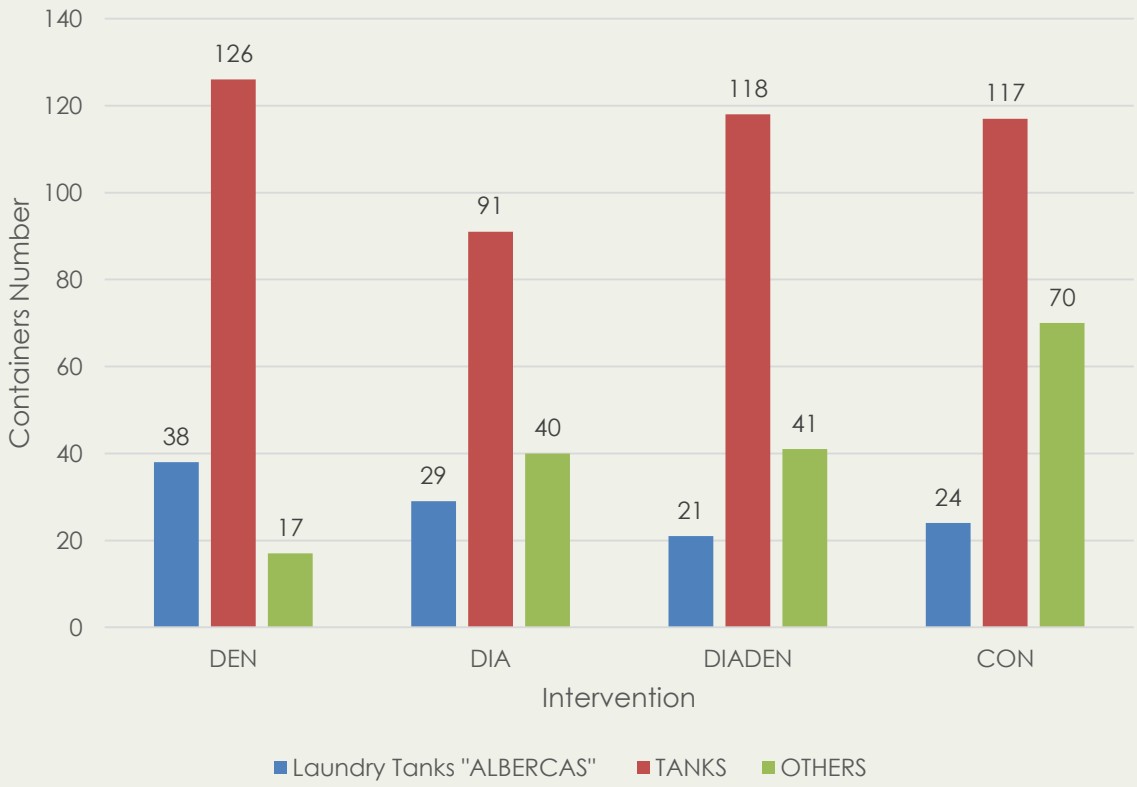


School Index

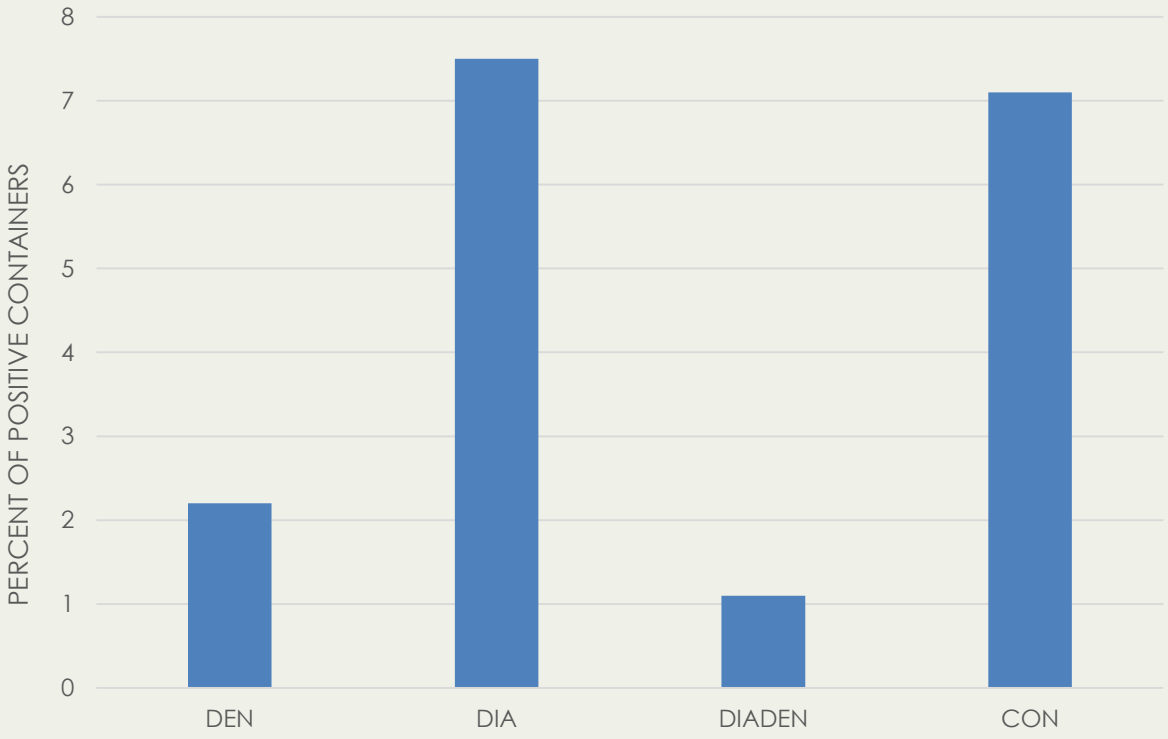


A = Anapoima School M = La Mesa School

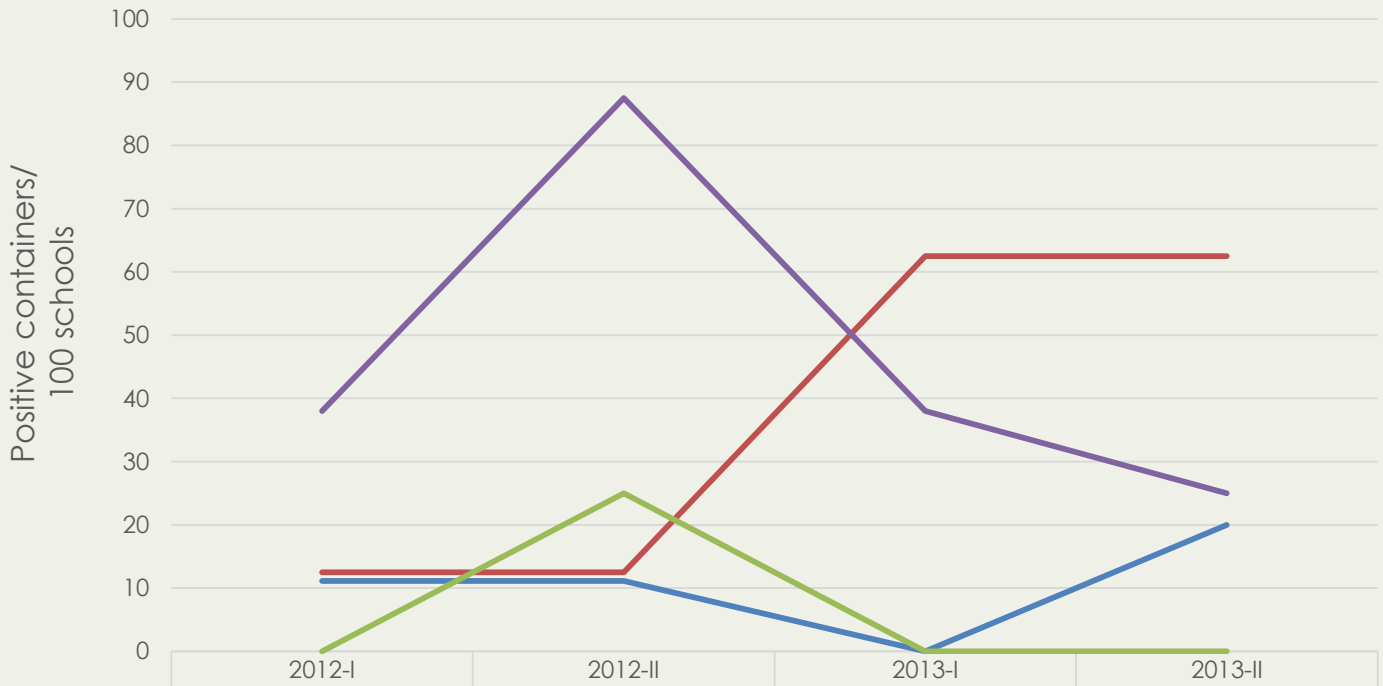
Type and Number of Containers Inspected



Container Index

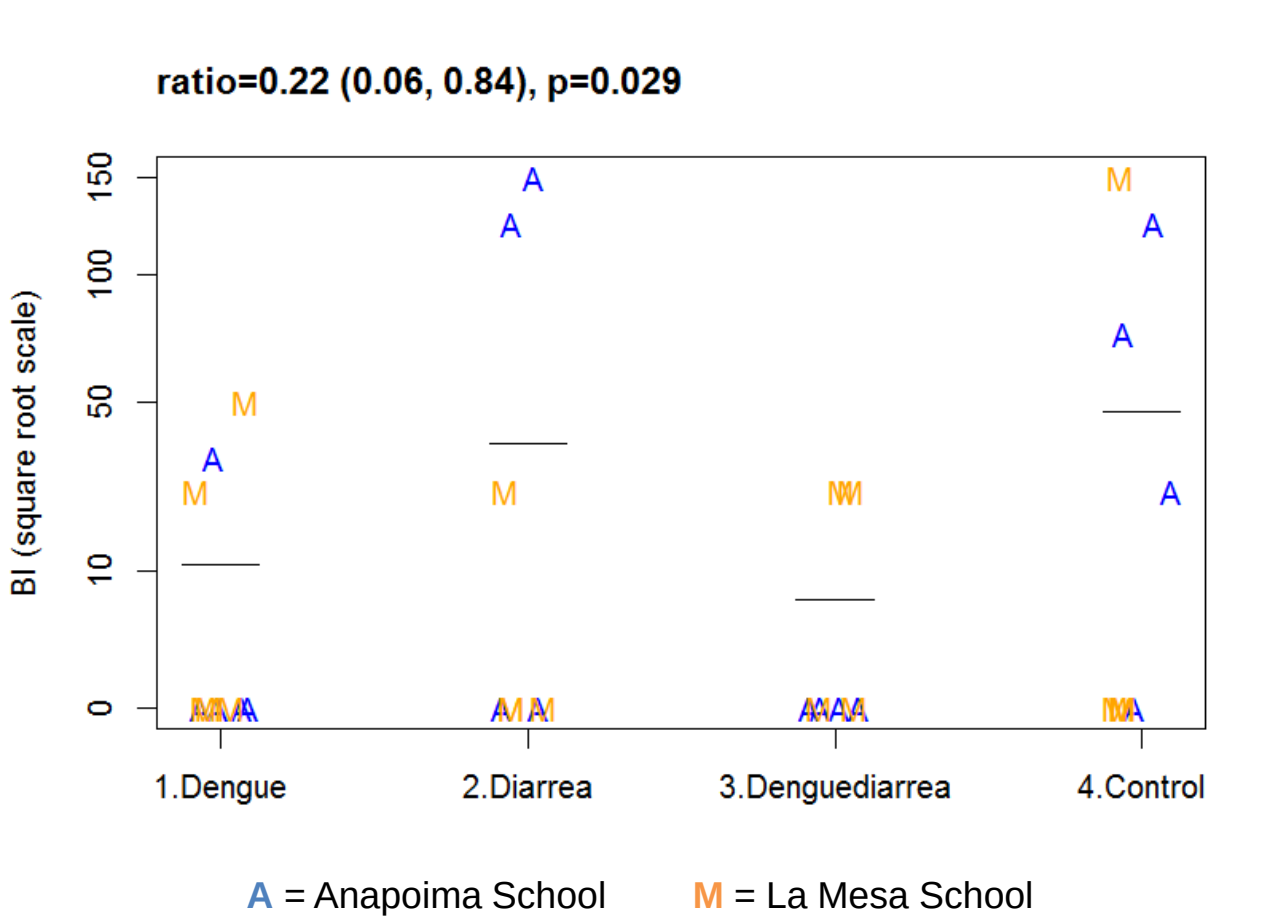


Breteau Index by Intervention Arm

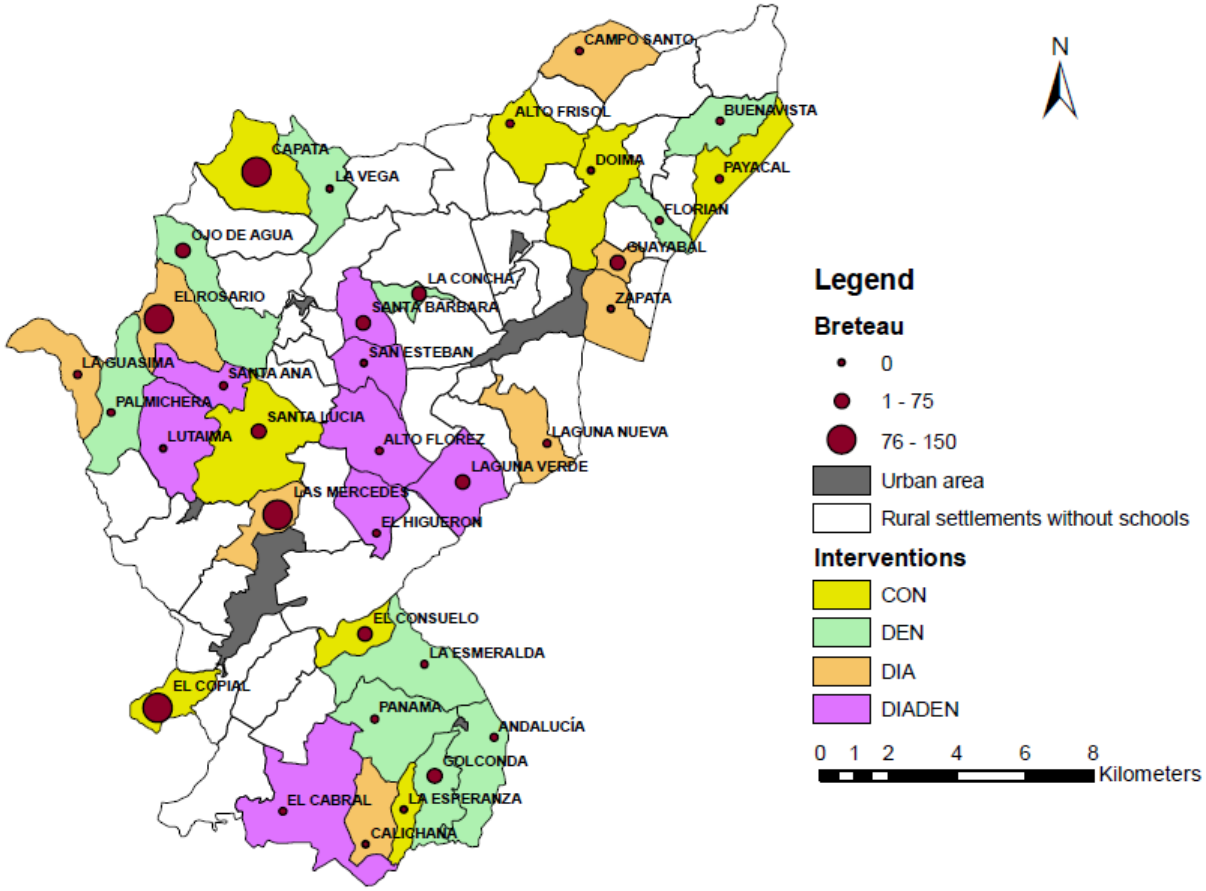


	2012-I	2012-II	2013-I	2013-II
Dengue	11	11	0	20
Diarrea	13	13	63	63
Dengue/diarrea	0	25	0	0
Control	38	88	38	25

Breteau Index



Breteau Index

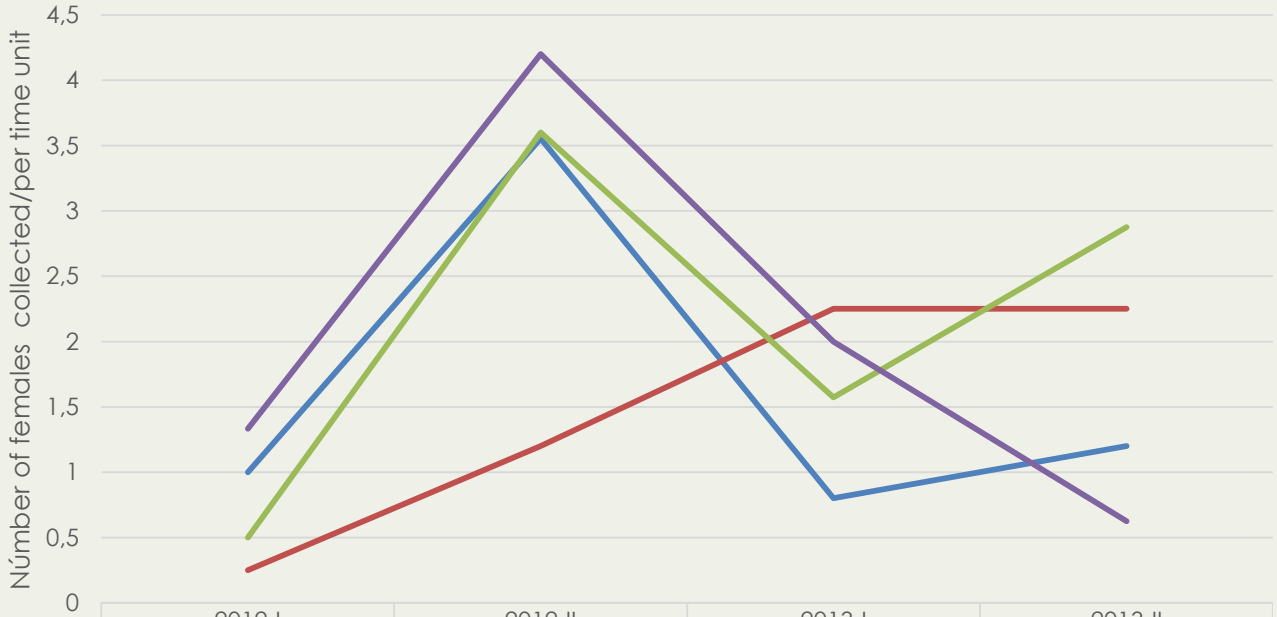


Pupae per Person Index*

	DENGUE	DIARREA	DENGUE/DIARREA	CONTROL
Total niños	454	543	425	473
Total pupas *Ae. aegypti*	17	59	37	103
Pupa per Person Index	0,04	0,11	0,09	0,22

* The threshold value of *Ae. aegypti* pupae per person index for dengue transmisión: 05-1.5
Source: Focks, D.A. Transmission thresholds for dengue in terms of *Aedes aegypti* pupae per person with discussion of their utility in source reduction efforts. Am. J. Trop. Med. Hyg. 62,11-18

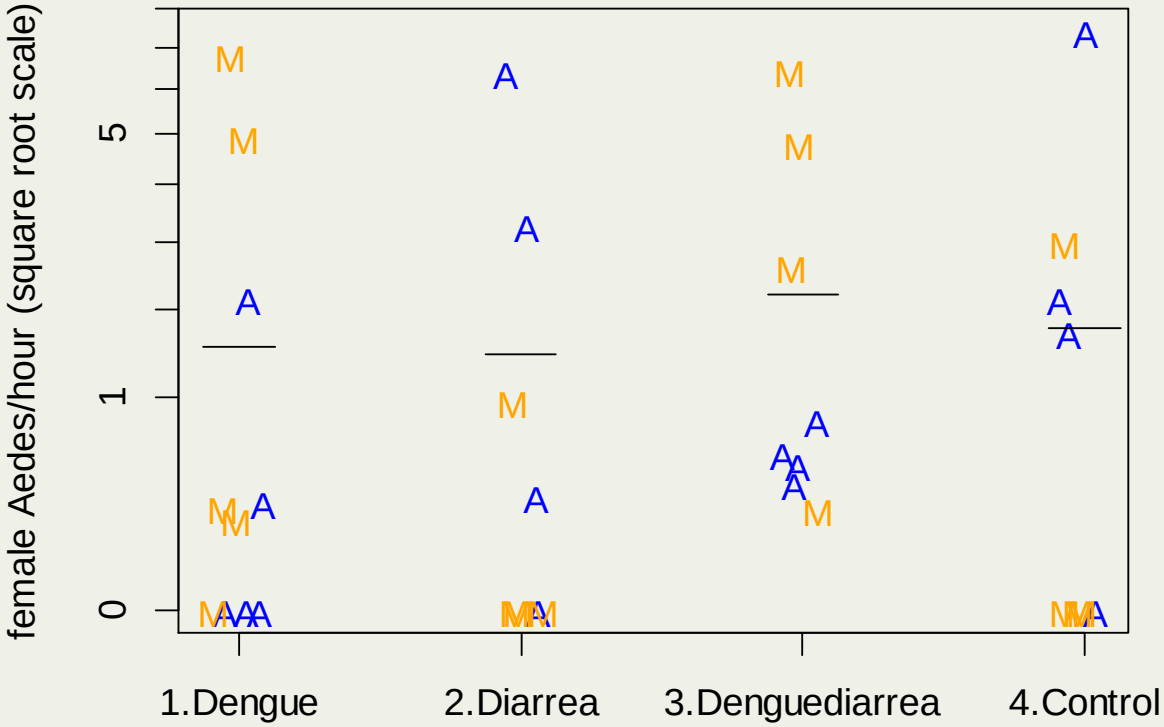
Density of *Aedes aegypti* Females by Intervention Arm



	2012-I	2012-II	2013-I	2013-II
Dengue	1	3,6	0,8	1,2
Diarrea	0,3	1,2	2,3	2,3
Denguediarrea	0,5	3,6	1,6	2,9
Control	1,3	4,2	2	0,6

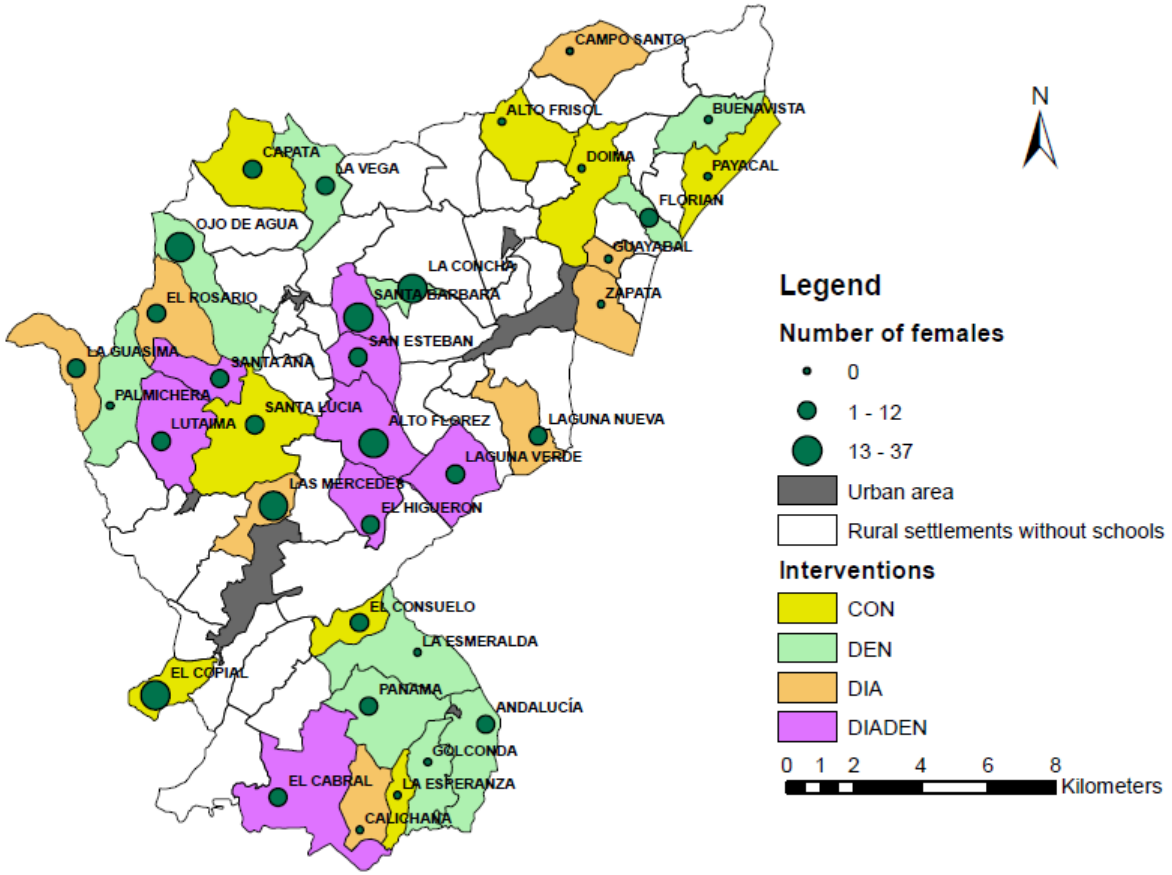
Density of *Aedes aegypti*/Intervention Arm

ratio=0.97 (0.2, 4.71), p=0.963

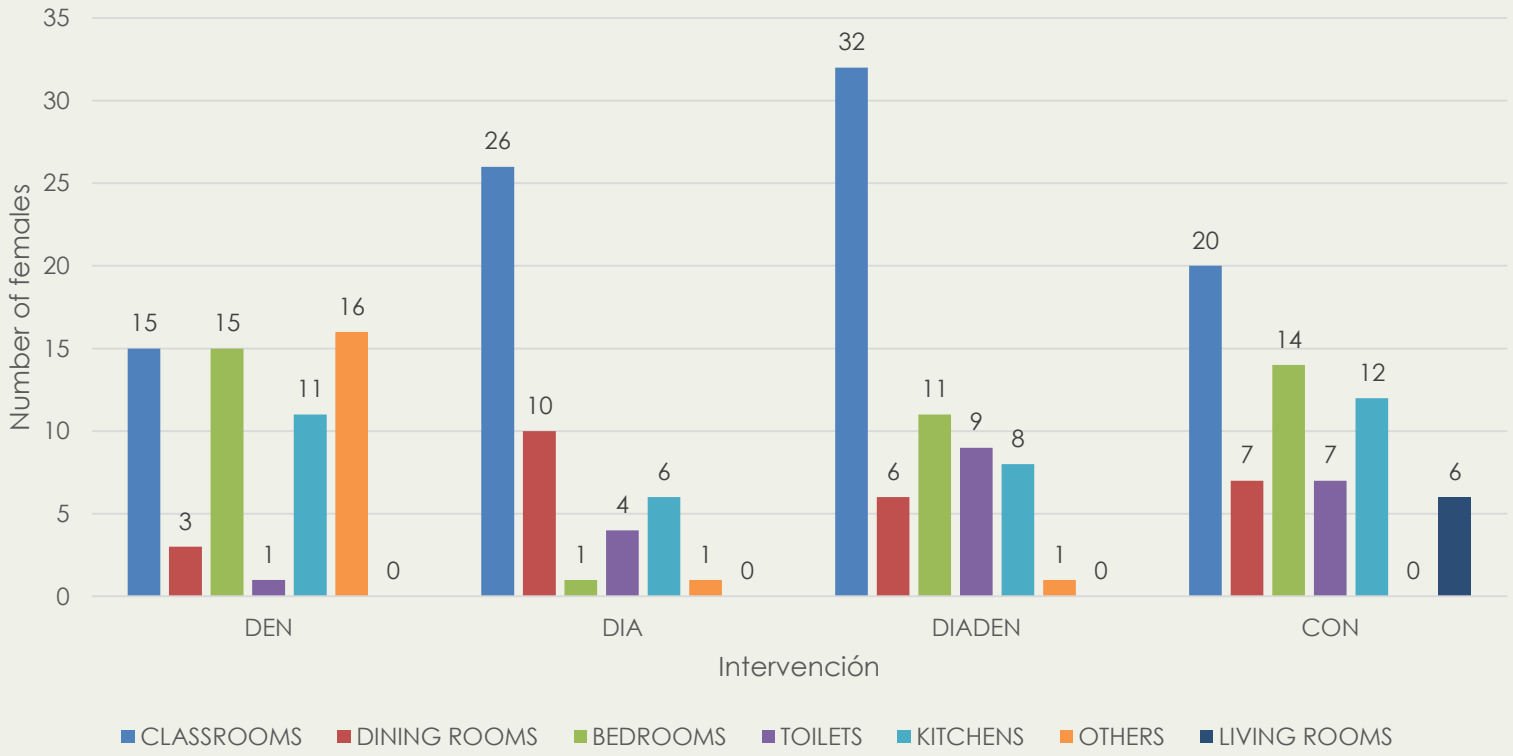


A = Anapoima School **M** = La Mesa School

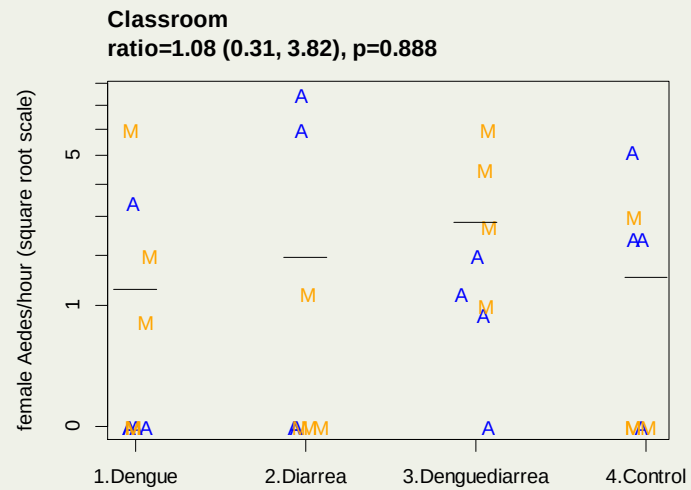
Number of Females Collected by School

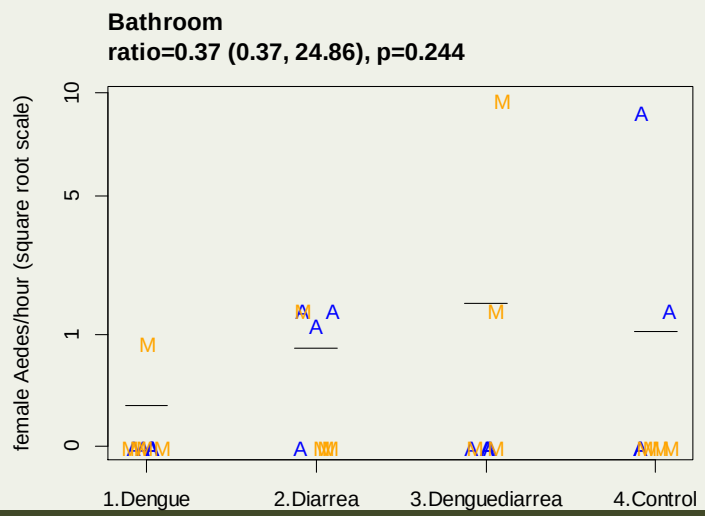


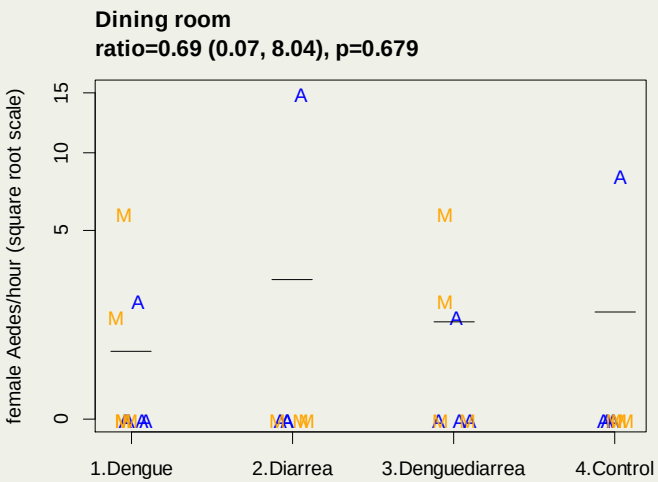
Number of *Aedes aegypti* Females Collected per Room Type



Density of *Aedes aegypti* Females Collected per Room Type

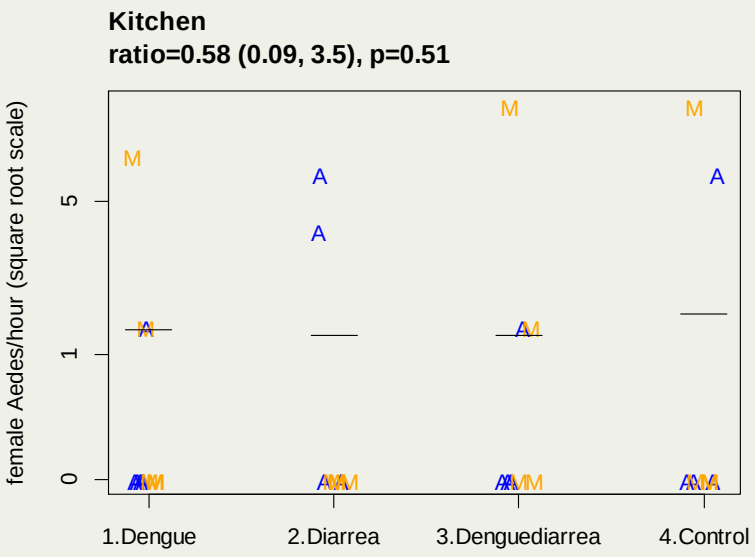


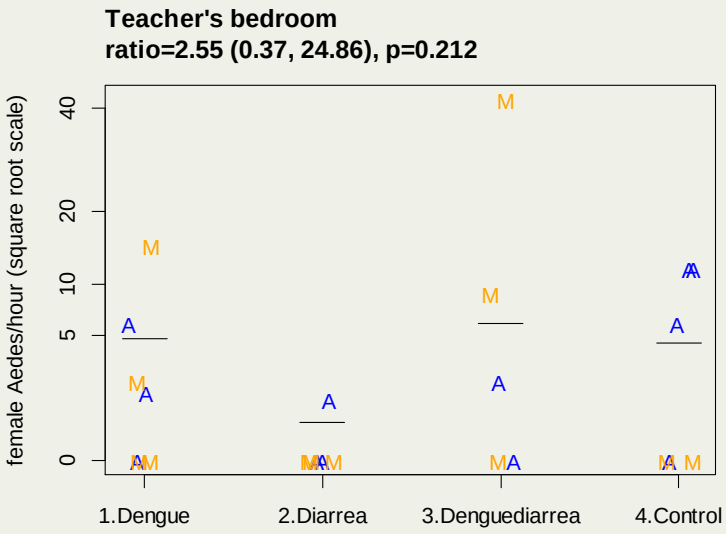




A = Anapoima School **M** = La Mesa School

Density of *Aedes aegypti* Females Collected per Room Type





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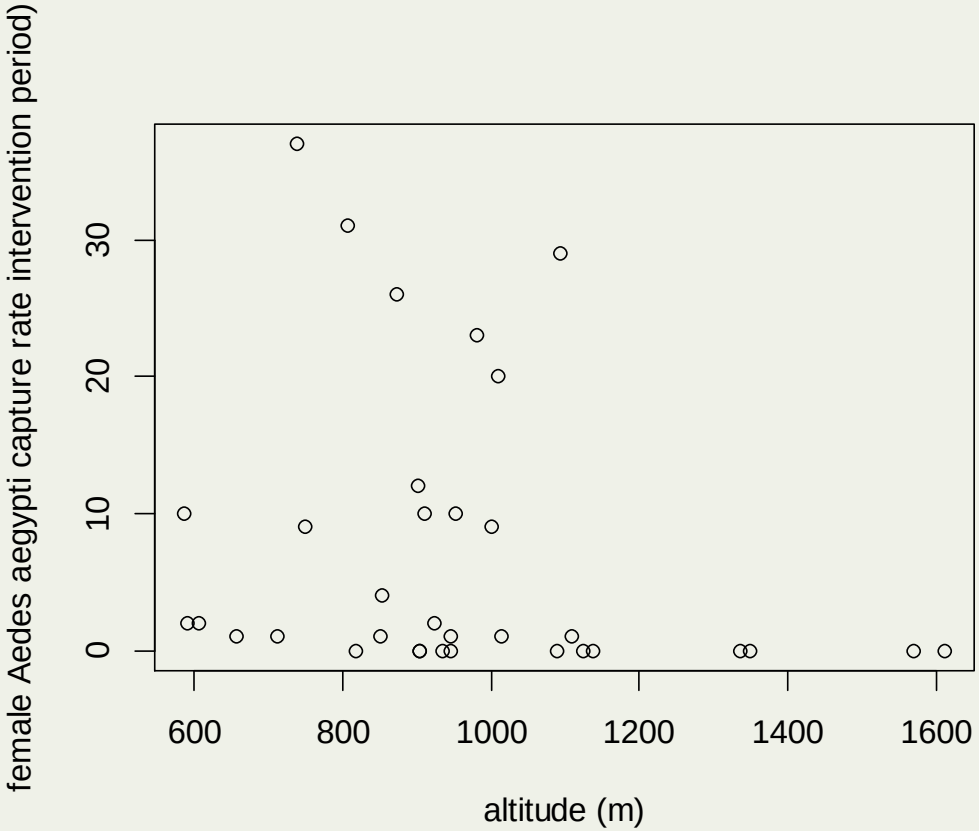
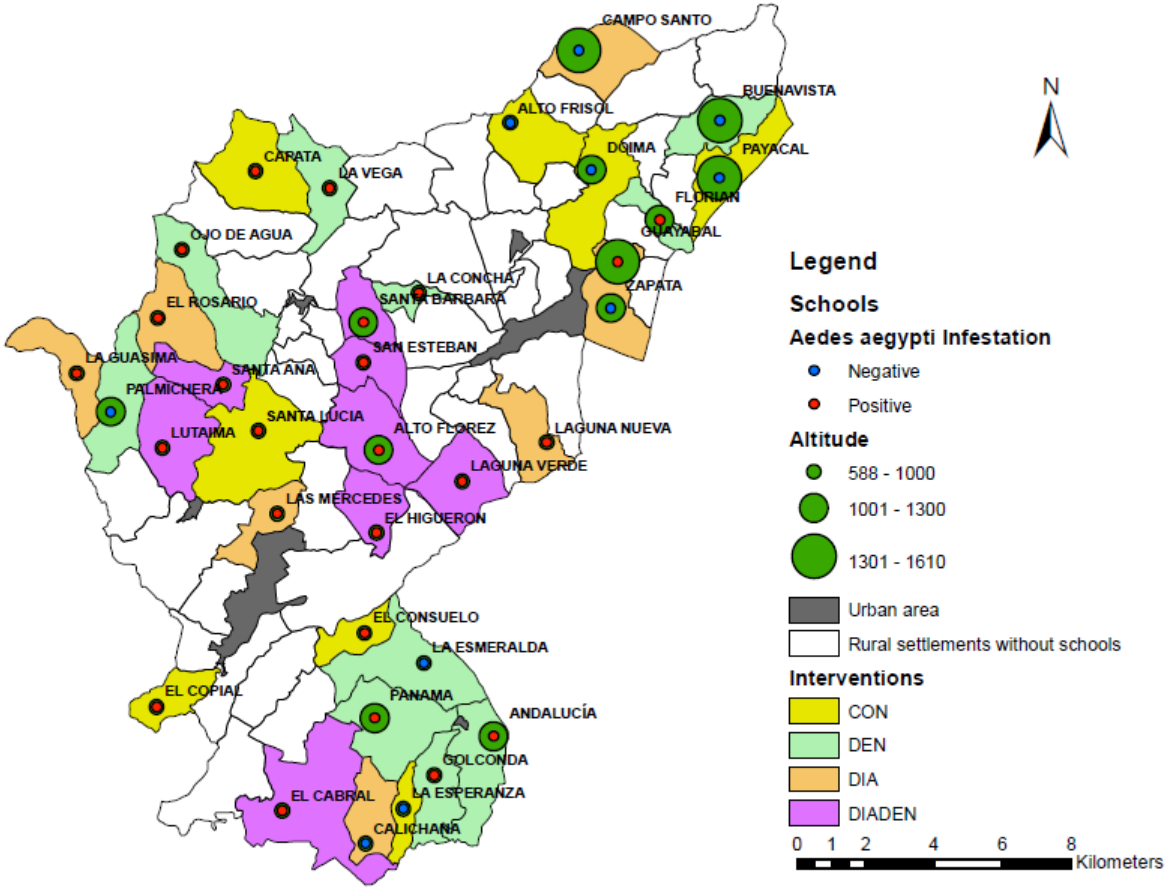
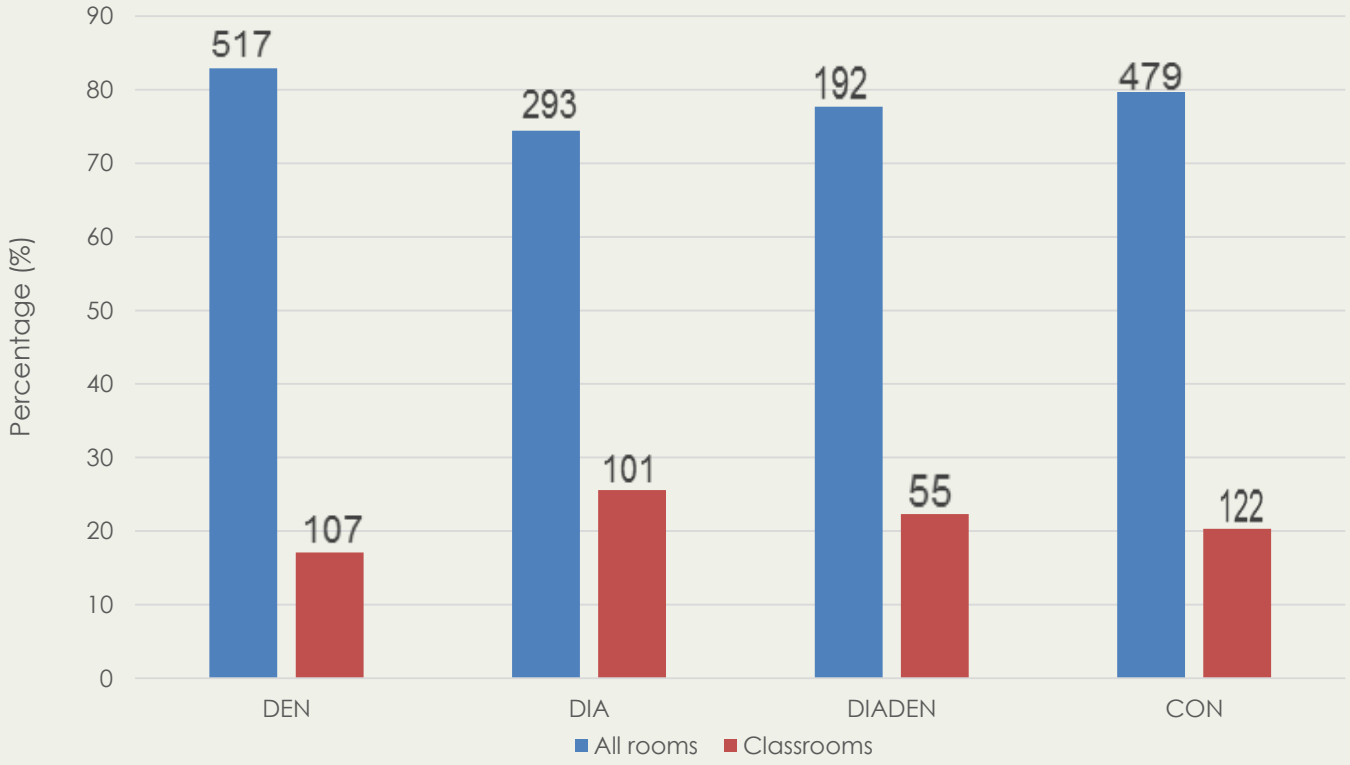
Presence of *Ae. aegypti* females and Altitude (m)



Presence of *Ae. aegypti* and Altitude (m)

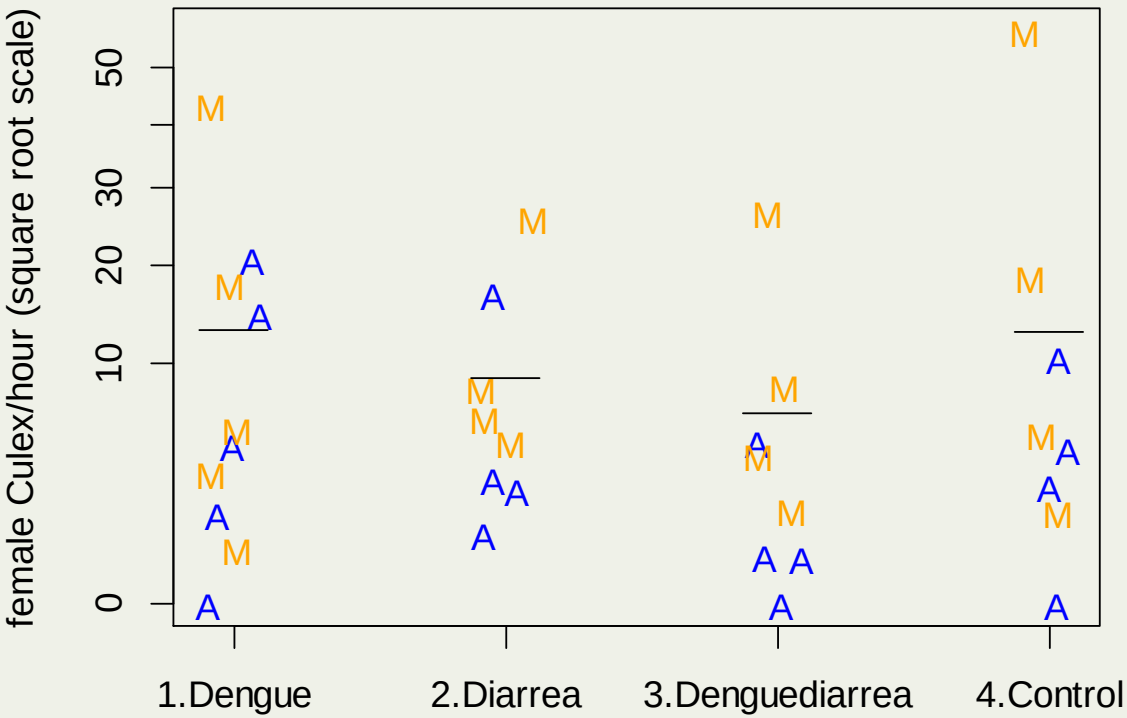


Proportion and Number of *Culex quinquefasciatus* Females Collected in All Rooms and Classrooms



Density of Cx. quinquefasciatus/ intervention Arm

ratio=0.79 (0.33, 1.83), p=0.564



A = Anapoima School **M** = La Mesa School

WHO Cone Bioassay Protocol

	SCHOOL	CURTAINS INSTALLED	No. SAMPLED CURTAINS		% Knock down	% Mortality
			SUN	SHADOW		
ANAPOIMA	La Palmichera	12	0	1	100	100
	El Cabral	24	2	2	100	100
	Golconda	6	-	-		
	Lutaima	12	4	0	100	100
	Panamá	8	-	-		
	El Higuerón	5	1	1	100	100
	La Esmeralda	14	-	-		
	Santa Ana	4	-	-		
	Andalucía	11	-	-		
TOTAL		**96**	**7**	**4**		
LA MESA	Florián	6	1	1	100	100
	Laguna Verde	12	0	2	100	100
	El Rosario	12	-	-		
	La Concha	17	3	2	100	100
	Santa Bárbara	16	0	2	100	100
	Buenavista	7	-	-		
	La Vega	5	1	1	100	100
	Alto de Flores	14	-	-		
	San Esteban	10	1	0	100	100
TOTAL		**99**	**6**	**8**		

Residuality: 6 – 12 – 18 months
Curtains were washed once

Mosquito Species Registered

- ***Anopheles pseudopunctipennis****
- ***Aedes fluviatilis***
- ***Aedes angustivittatus***
- ***Culex quinquefasciatus*****
- ***Culex nigripalpus***
- ***Culex corniger***

* Secondary vector of malaria

** Vector of jungle yellow fever

*** Vector of west Nile virus

- ***Culex coronator***
- ***Haemagogus equinus*****
- ***Limatus durhamii***
- ***Psorophora ferox ******
- ***Toxorhynchites sp.***
- ***Trichoprosopon lampropus***

**** Venezuelan equine encephalitis vector

Conclusions

- The principal breeding sites for *Ae. aegypti* were drinking water storage containers followed by containers classified as 'other' (bottles, discarded food waste, plastic cups, cans) and cement wash basins (used for storing water for washing clothes).

- School and Breteau Indices were significant lower in the DENGUE and DIADEN arms compared to the DIA and CONTROL arms ($p < 0.05$).

Conclusions

- No significant difference in the density of *Ae. aegypti* females/school in the DEN and DIADEN arms (that received the curtain intervention) compared to the other arms.

- No significant differences between arms in the number of females mosquitoes collected in different rooms ($p>0.05$).

- Other mosquito species of public health importance were collected.

Limitations

The main control method targeting *Aedes aegypti* females, i.e. insecticide treated curtains, did not perform well enough:

- There are many openings, e.g. doors, eaves, ventilation holes etc. that could not be covered by the curtains.
- Mosquitoes breed in habitats that were not targeted in our interventions and adult mosquitoes can fly to the schools from the surrounding areas.

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