

# INOVEC

Intelligent traps for real time  
surveillance of mosquitoes

# ABOUT US

- Founded in 2014
- Two divisions: OEM R&D and Manufacturing
- Core competencies:
  - Electronic design
  - Embedded software development
  - Wireless communications
  - IoT server development
  - Machine learning systems
- Own products:
  - Senscape® IoT platform



**Senscape**<sup>®</sup> is a standards-based IoT platform based on a unique and powerful combination of hardware modules and highly customizable cloud and mobile applications, to enable the development and delivery of professional and fast time-to-market IoT solutions.



**5X FASTER**

**5X LESS RESOURCES**

**5X CHEAPER**



**IDEA**

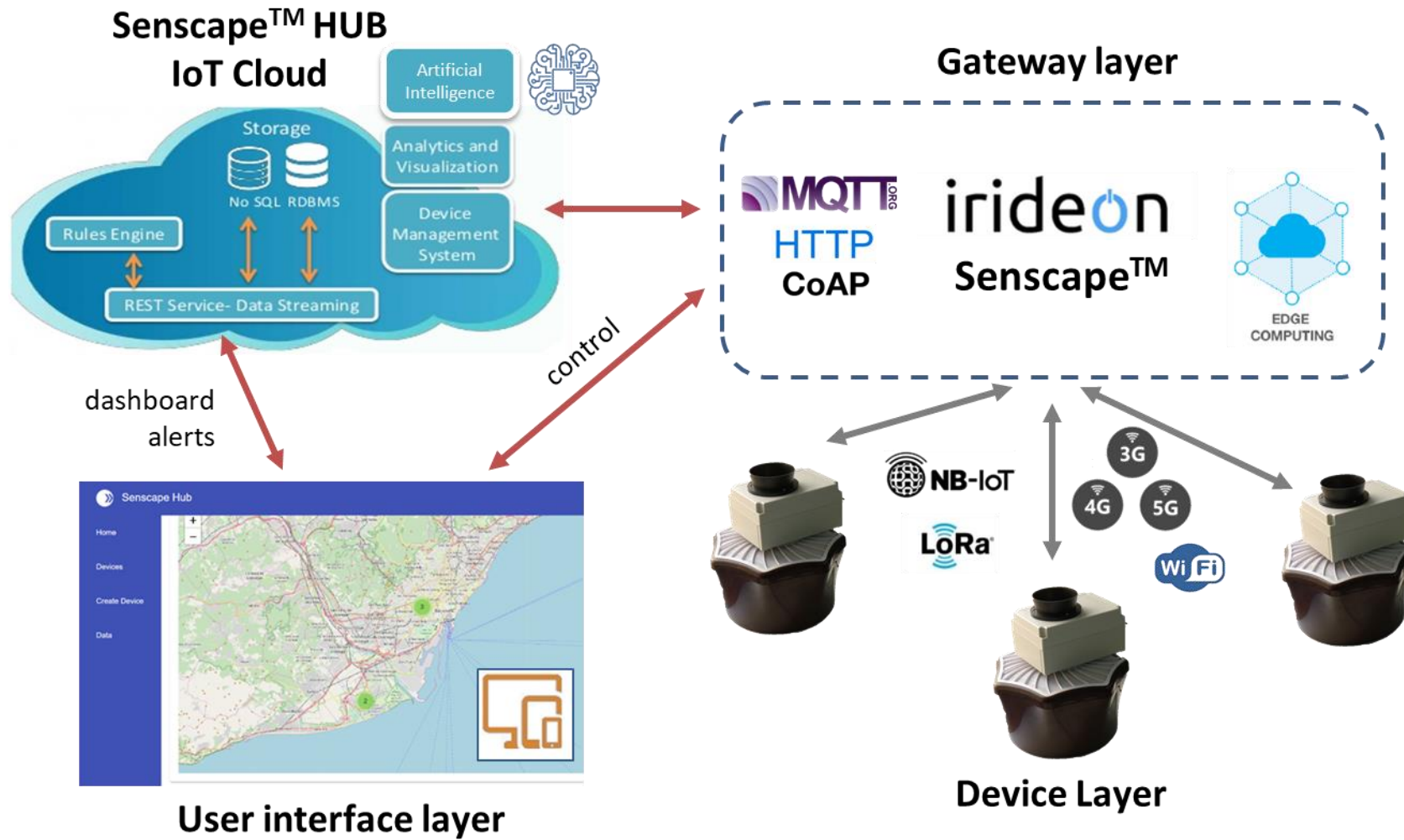
**DESIGN**

**PROTOTYPE**

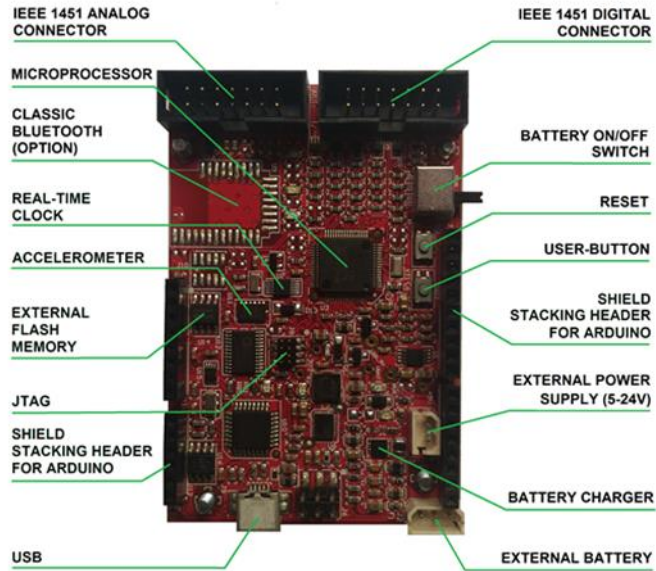
**PILOT**

**MARKET**

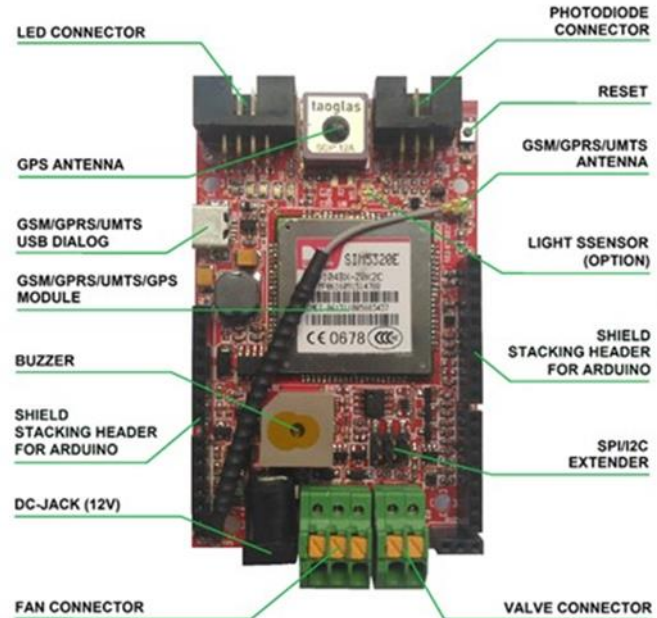
# IoT sensor application



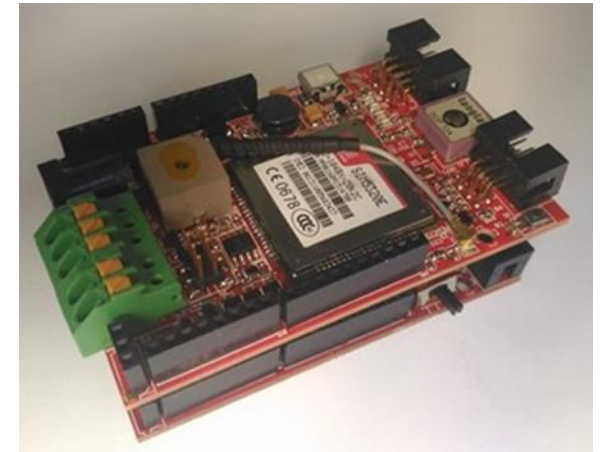
# Internal electronics of sensor



The internal processor board, is also a cost-effective, low power consumption, and flexible platform for other IoT solutions

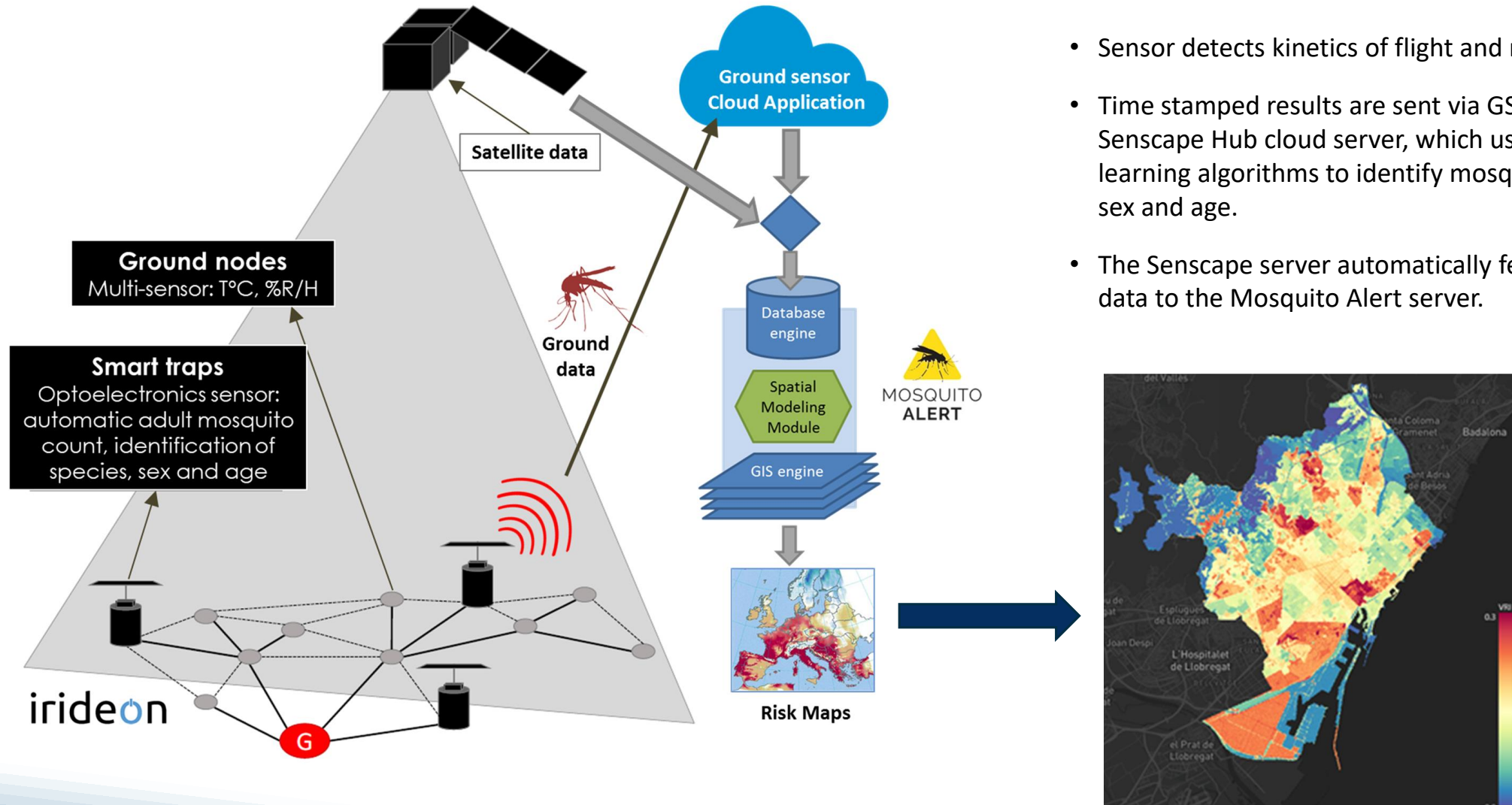


Internal, plug-in shield board. Contains a worldwide GSM/ GPRS/ UMTS/ EDGE/ HSDPA modem, power inputs and fan and CO<sub>2</sub> valve outputs. I2C interface for connection to T & %RH and other (optional) I2C sensors.



Shield board (top), plugged into the processor board (bottom)

# IoT sensor- ground node role overview



- Sensor detects kinetics of flight and morphology.
- Time stamped results are sent via GSM to our Senscape Hub cloud server, which uses machine learning algorithms to identify mosquito species, sex and age.
- The Senscape server automatically feeds the data to the Mosquito Alert server.

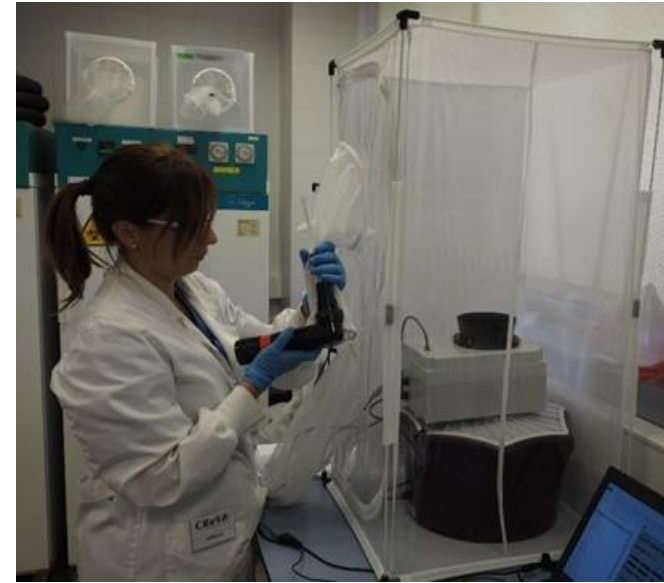
# Tests with mosquitoes



*Rearing mosquitoes in the lab*



*Sensor coupled to a commercial trap inside a insect cage.*



## Parasites & Vectors

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Research | [Open Access](#) | [Published: 06 June 2022](#)

### A novel optical sensor system for the automatic classification of mosquitoes by genus and sex with high levels of accuracy

[María I. González-Pérez](#), [Bastian Faulhaber](#), [Mark Williams](#), [Josep Brosa](#), [Carles Aranda](#), [Nuria Pujol](#), [Marta Verdún](#), [Pancraç Villalonga](#), [Joao Encarnação](#), [Núria Busquets](#) & [Sandra Talavera](#) [✉](#)

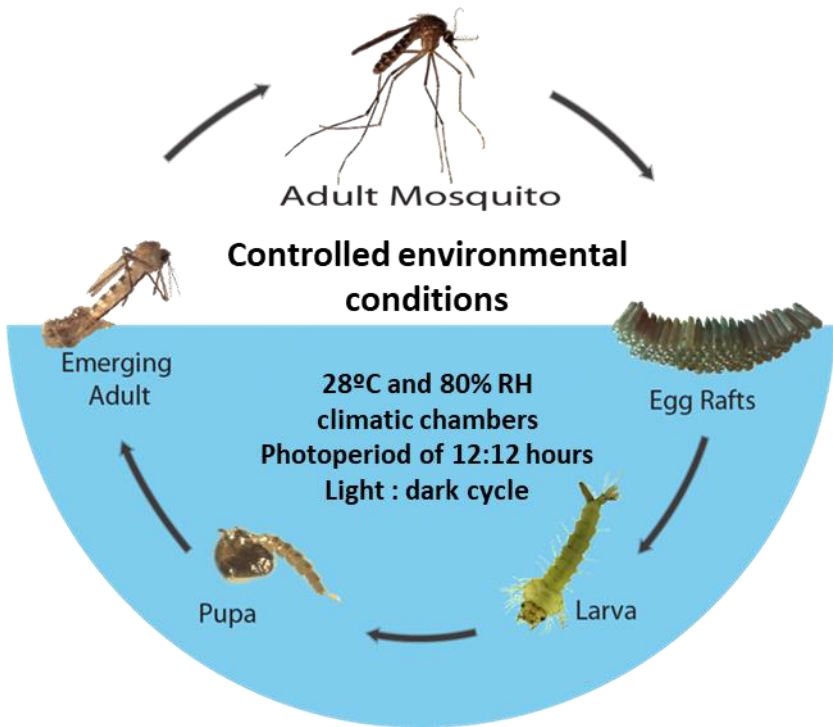
[Parasites & Vectors](#) **15**, Article number: 190 (2022) | [Cite this article](#)

**355** Accesses | **3** Altmetric | [Metrics](#)

In collaboration with:



# Continuous studies with different mosquito species



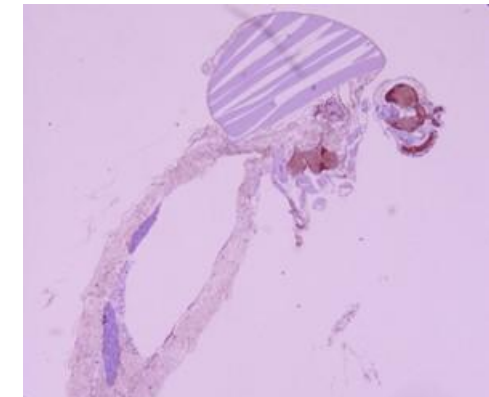
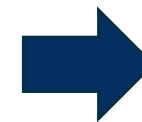
## Species list (target species)

- ✓ *Aedes aegypti*
- ✓ *Aedes albopictus*
- ✓ *Aedes caspius*
- ✓ *Aedes vexans*
- ✓ *Anopheles atroparvus*
- ✓ *Culex laticinctus*
- ✓ *Culex pipiens*
- ✓ *Culex theileri*
- ✓ *Culex hortensis*
- ✓ *Culiseta longiareolata*
- ✓ *Chironomidae*

## Variables list

- ✓ *Species*
- ✓ *Sex*
- ✓ *Age (2-14 days)*
- ✓ *Temperature (18-28°C)*
- ✓ *Size (large, small)*
- ✓ *Parity (nulliparous, parous, blood fed, gravid)*
- ✓ *Nutritional status (starved, sugar fed, blood fed)*

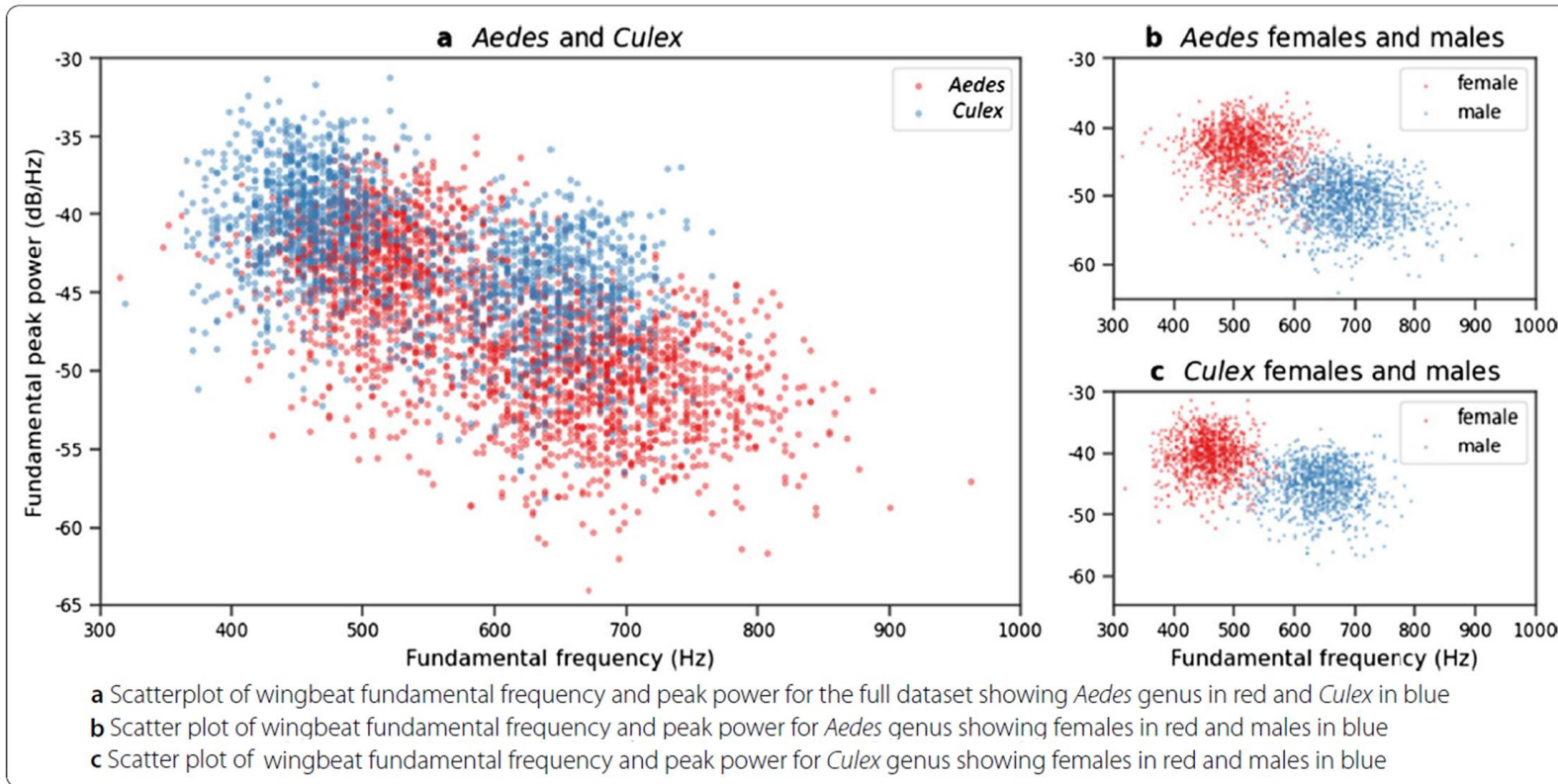
**Additional study:** Infection of one target specie with one arbovirus (Yellow fever, WNV, Zika, Dengue...) to asses if virus can affect mosquito flight



Histological sections of *Aedes albopictus* intrathoracic inoculated with RVFV (14 days post inoculation)



# Machine Learning to differentiate mosquitoes- results so far



Classification task	Using the test set			Using the training dataset			Error analysis indication
	Best test accuracy (%)	Best feature	Best algorithm	No. of samples	Training accuracy (%)	Validation accuracy (%)	
Genus	94.2	Spectrogram	DNN	2016	100	95	Slight overfitting: more training samples
Sex <i>Aedes</i>	99.4	Spectrogram	LR	1008	99.5	99.5	No overfitting
Sex <i>Culex</i>	100	MFCC	LR, GB	1170	100	100	No error
		PSD	SVM				
		Spectrogram	LR, SVM, DNN				
		MFCC	All algorithms				

# Thank you for your attention

## LOCATION MAP



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