YEAR 2020 Surveillance of *Aedes albopictus* mosquitoes vectors of ZIKA in urban area

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Faculty of sciences
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ABSTRACT

Aedes albopictus strongly present in urban areas at Madagascar are incriminated to be potential vectors of virus ZIKA . Thus, even if Madagascar is safe of ZIKA ,the country is vulnerable , and surveillance is necessary to supervise mosquitoes pullulation and prevent outbreaks .
Using data GLOBE offers tools to carry out a monitoring of *Aedes albopictus* in order to assess the size and the dynamism of its populations in urban area , and to predict a risk of transmission of arboviruses .
That was the aim of our project submitted to ZIKA GLOBE on July 2019 .
Before , during and after the rainy season , studies must be conducted in the university campus and its immediate surroundings , by capturing adults, collecting eggs from ovitraps and prospecting breeding sites .
The rainy season started on December still up to now (March 2020).
Productives breeding sites were identified , observed and photos shared
Larvae , pupae were counted ,taken in photos ,identified and shared .
Positive containers are eliminated. Emergent adults were seen ,collected and identified. Precipitations are shared.The preliminary results during this season , highlight that : a rise in precipitation precede an adult outbreak.
Our team also, was granted for actively took cloud and sky observations during the NASA GLOBE 2019 Fall Cloud Challenge and we always do this motivated task . We had workshop sharing ZIKA Project to GLOBE Community in Madagascar.

Keywords: *Aedes albopictus*, entomological surveillance, urban area, Madagascar

REVIEW OF LITTERATURE

CLASSIFICATION of *Aedes albopictus* (source Fontenille D.)

Règne	: Animal
Sous règne	: Métazoaires
Embranchement	: Arthropodes
Sous embranchement	: Antennates
Classe	: Insectes
Sous classe	: Ptérygotes
Section	: Néoptères
Super Ordre	: Mécoptéroïdes
Ordre	: Diptères
Sous ordre	: Nématocères
Infra Ordre	: Culicimorpha
Famille	: Culicidae
Sous Famille	: Culicinae
Tribu	: Aedini

Photo II.1 : Adulte d'*Aedes albopictus*

Female Adult of *Aedes albopictus*

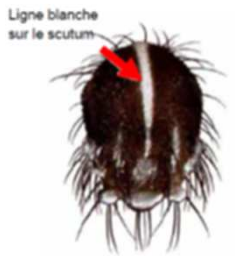


Figure II.2 : Ligne blanche sur le scutum d'*Aedes albopictus* (Magnolia Press2004 (Auckland, New Zealand)

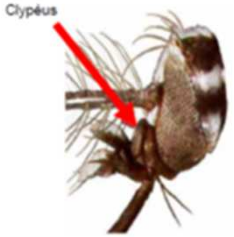


Figure II.3: Clypéus entièrement noir d'*Aedes albopictus* Magnolia Press2004 (Auckland, New Zealand)

Identification larvae L4 of *A. albopictus*

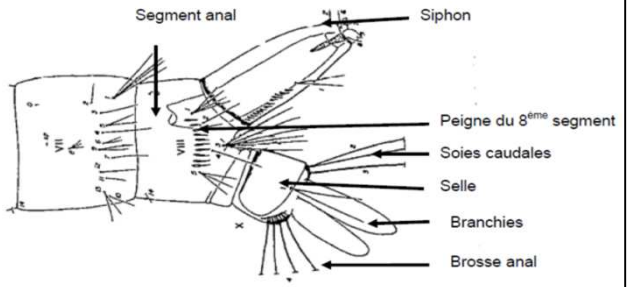


Figure II.4 : Segment terminal des larves d'*Aedes albopictus* (Ravaonjanahary 1978)

REVUE OF LITTERATURE

ZIKA virus is an isolated African virus in 1947 in Uganda (1)
It belongs to the family Flaviviridae and genus Flavivirus

The clinical syndrome is known as ZIKA fever (2) and shows febrile illness, sometimes weak or absent, may be associated with an eruption maculopapular, beginning on the face extending to the rest of the body 'accompanying, headache, conjunctivitis, arthralgia. (3)

The ZIKA virus is transmitted to humans by the bite of an infected mosquito, which itself infects during a blood meal on an infected vertebrate subject (2)

1. **AUBRY P. et ALEX-GAÜZERE B., 2015.** - Arboviroses tropicales-Actualités Mise à jour le 23/01/2015 MEDICINE TROPICALE Diplôme de Médicine Tropicale des Pays de l'Océan Indien

2. BRIAN D. F., KOBYLINSKI K. C., CHILSON FOY L. J., BLITVICHl J. B.,TRAVASSOS DA ROSA A., HADDOW D. A., LANCIOTTI R. et TESH R.B., 2011 - « Probable non-vector-borne transmission of Zika virus,Colorado, USA », *Emerg Infect Dis.*, vol. 17, no 5, 2011, p. 880-882

3. POULAIN V. 2008 - Évaluation de la possibilité d'adaptation d'un modèle de risque climatique de transmission de la dengue à la transmission du virus Chikungunya par *Aedes albopictus* dans le nord de l'Italie, 6p

Our research problem ,questions and objectives stay the same proposed on 2019

RESEARCH PROBLEM

ZIKA virus has not yet been detected in the Indian Ocean region although vectors are present .
Surveillance of *Aedes albopictus* major vector of the virus ZIKA urban area is an imperative strategy to trigger an alert and to prevent possible epidemics that will affect everyone.
Such action should be carried out at several levels, and GLOBE schools are one of the observation platforms for these vectors.
Surveillance must be combined with environmental control and community education to success the goal to prevent outbreak of ZIKA
A basic and primary approach to control can be conducted by GLOBE schools through monitoring of eggs and larvae and pupae.
Entomological index are emplemented by undergraduates and high schools GLOBE.

RESEARCH OBJECTIVES

The main research objective of the project is to carry out monitoring of *Aedes albopictus*, potential vector of ZIKA in order to assess the size and the dynamism of its populations in an urban area using data GLOBE and predict a risk of transmission of this arbovirus

Specific objectives are to develop :

-easy Protocoll of studing *Aedes albopictus* for scientific awakening GLOBE elementary schools and others levels

-surveillance entomological observins eggs , larvae and pupae protocolls to predict a risk of transmission of arboviruses

-contribute to the fight against vector using ovitraps protocoll

RESEARCH QUESTIONS

The research questions for the project are :

Does the use of GLOBE data make it possible to understand that the urban area is vulnerable to the transmission of ZIKA through the observations of the mosquito vector dynamic ?

What vector control strategy is reachable to GLOBE schools and to the community?

Answers to these research questions are important and have real scientific interests. Scientists can use shared data and apply them in multiple areas of vector control and public health issues

These observations concern aspect of Earth's environment in particular environmental safety through community education , students formation and schools GLOBE.

RESEARCH METHODS

During the research, the students were trained on GLOBE OBSERVER

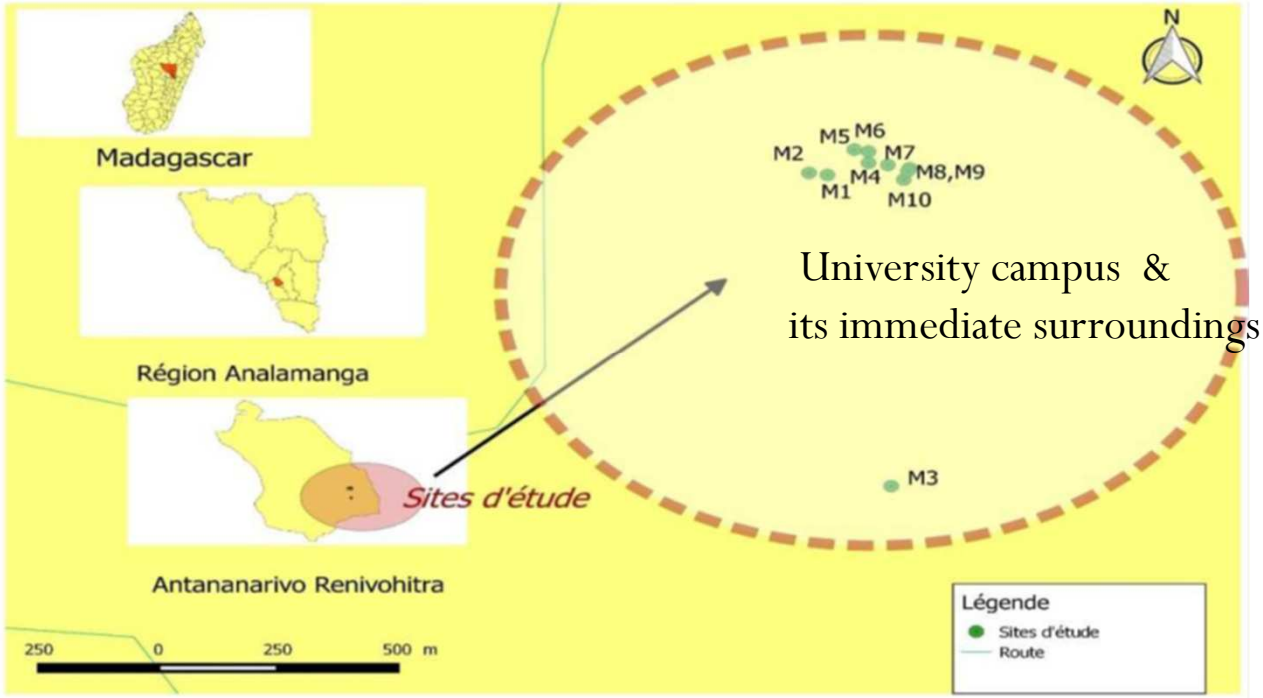
- GLOBE HYDROLOGY PROTOCOL on measuring pH using pH meter
  on measuring temperature
- GLOBE ATMOSPHERE PROTOCOL on measuring temperature & rainfalls
- MOSQUITO PROTOCOL for *Aedes albopictus*

So,

- pH, temperature of larvae breedings are weekly collected
- Aereal temperature and rain falls were collected daily
- Larvaes containers and ovitraps are collected weekly in urban earea (gardens, yards)

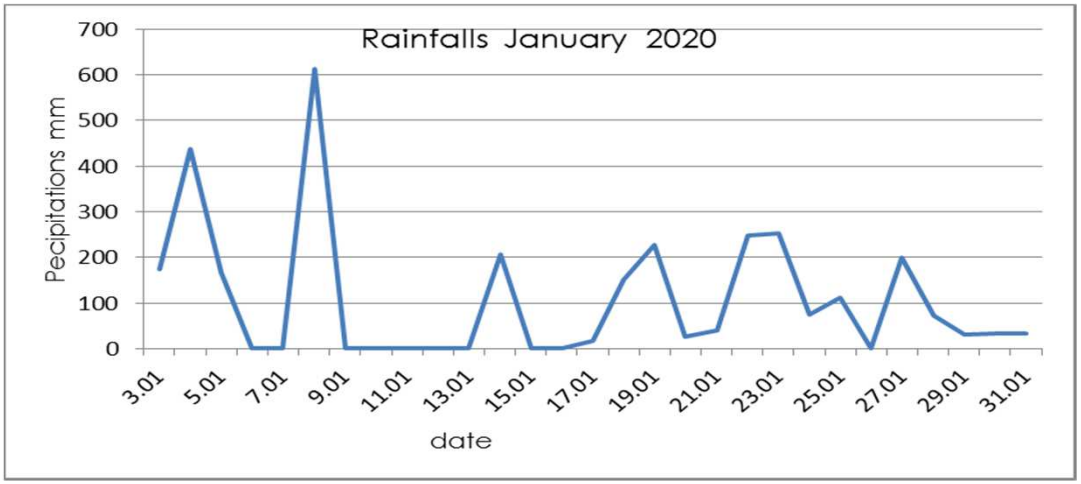
- Study sites : data are collected in the university campus and its immediate surroundings because the university campus gather students from all parts of the island and the population living near this university city is vulnerable.

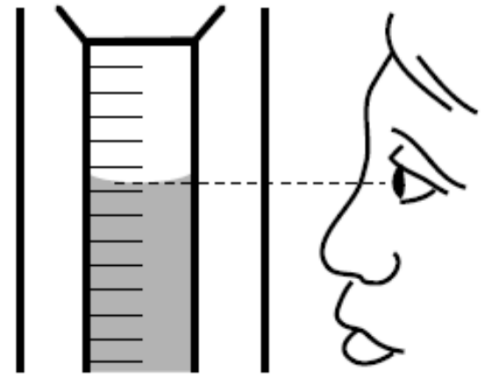
Study sites


Madagascar
Région Analamanga
Antananarivo Renivohitra
Sites d'étude
N
M1
M2
M3
M4
M5
M6
M7
M8,M9
M10
University campus &
its immediate surroundings
Légende
Sites d'étude
Route
250
0
250
500 m

RESEARCH RESULTS

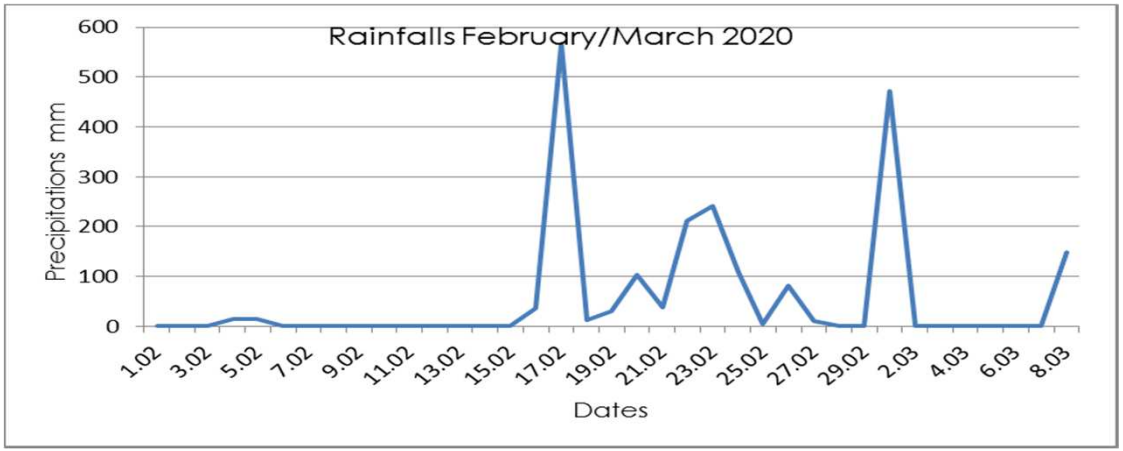
DATA GLOBE RAINFALLS
Latitude -18.9248
Longitude 47.5549





Using a rain gauge to measure the daily amount of precipitation

After important rainfalls, there are many containers colonized by mosquitoes



RESEARCH RESULTS SHARED

DATA GLOBE OBSERVER MOSQUITO HABITAT
Latitude -19.8539
Longitude 47.0331

During dry season , no *Aedes* recensed in our collects. Some larvae of *Culex quinquefasciatus* are identified in this area

RESEARCH RESULTS SHARED

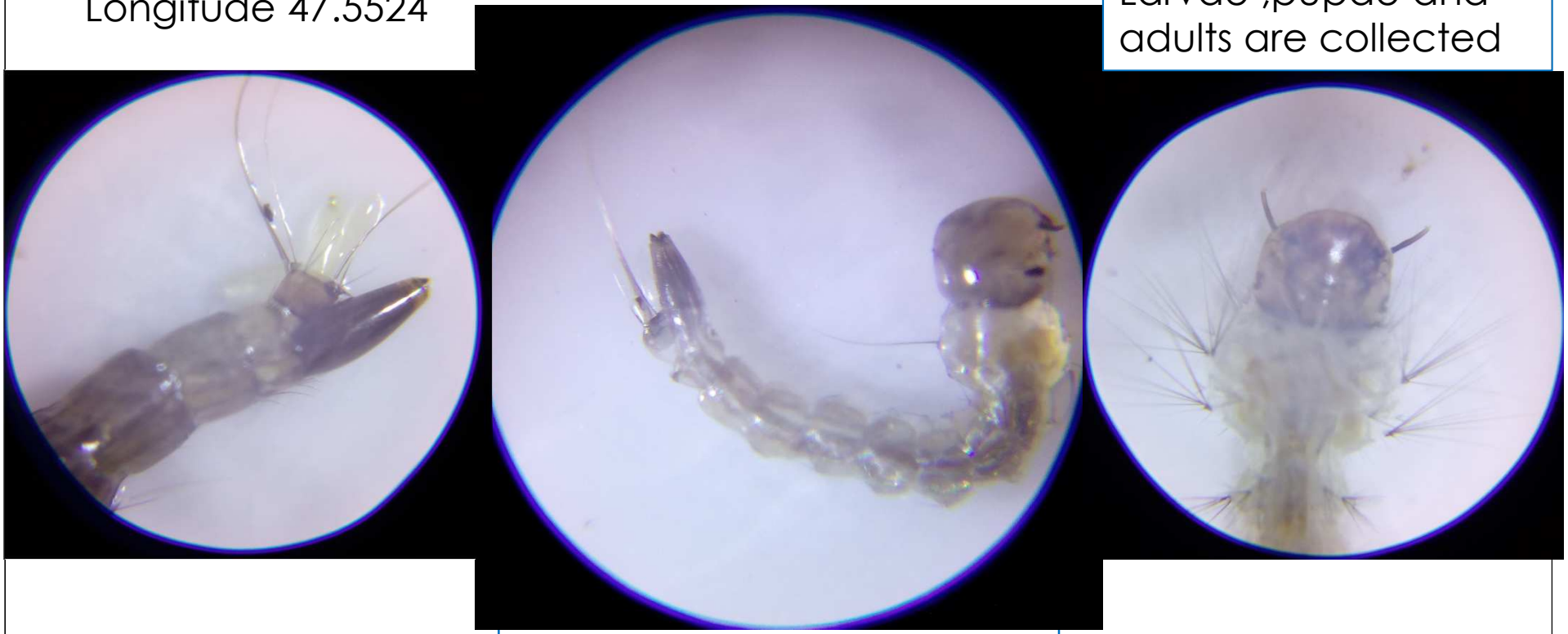
DATA GLOBE OBSERVER MOSQUITO HABITAT
Latitude -19.8539
Longitude 47.0331

Some photos of Mosquitoes habitats shared /GLOBE Observer

RESEARCH RESULTS SHARED

DATA GLOBE OBSERVER MOSQUTO HABITAT
Latitude -18.9235
Longitude 47.5524

During rainy season and after important rainfalls,
Larvae ,pupae and adults are collected



Larvae of *Aedes albopictus*

On 08th March 2020 , 32 larvae are collected from artificial container :
27 are *Anopheles sp* and 5 *Aedes albopictus*

RESEARCH RESULTS SHARED

DATA GLOBE OBSERVER MOSQUTO HABITAT
Latitude -18.9235
Longitude 47.5524

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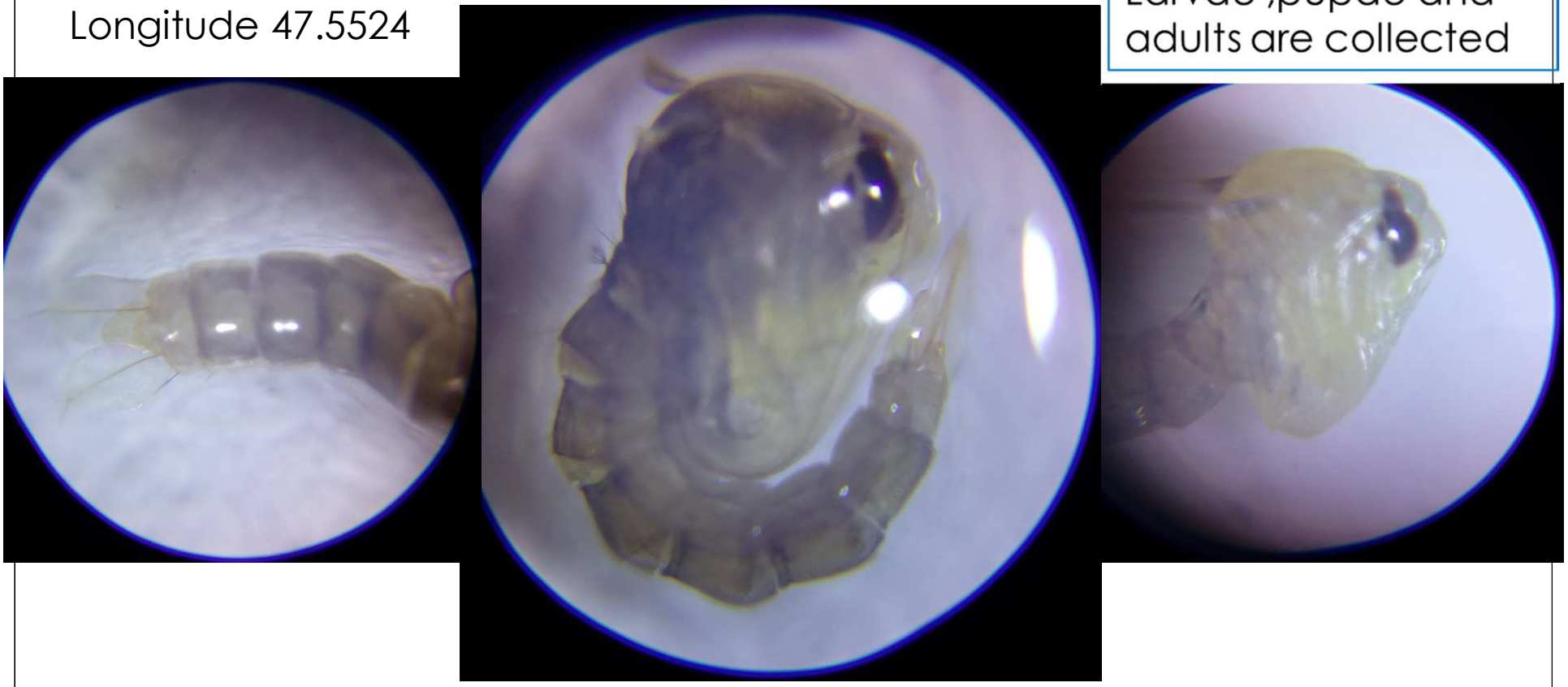

On 08th March 2020 , 5 pupae of *Aedes albopictus* are collected from artificial container

RESEARCH RESULTS SHARED

DATA GLOBE OBSERVER MOSQUTO HABITAT
Latitude -18.9235
Longitude 47.5524

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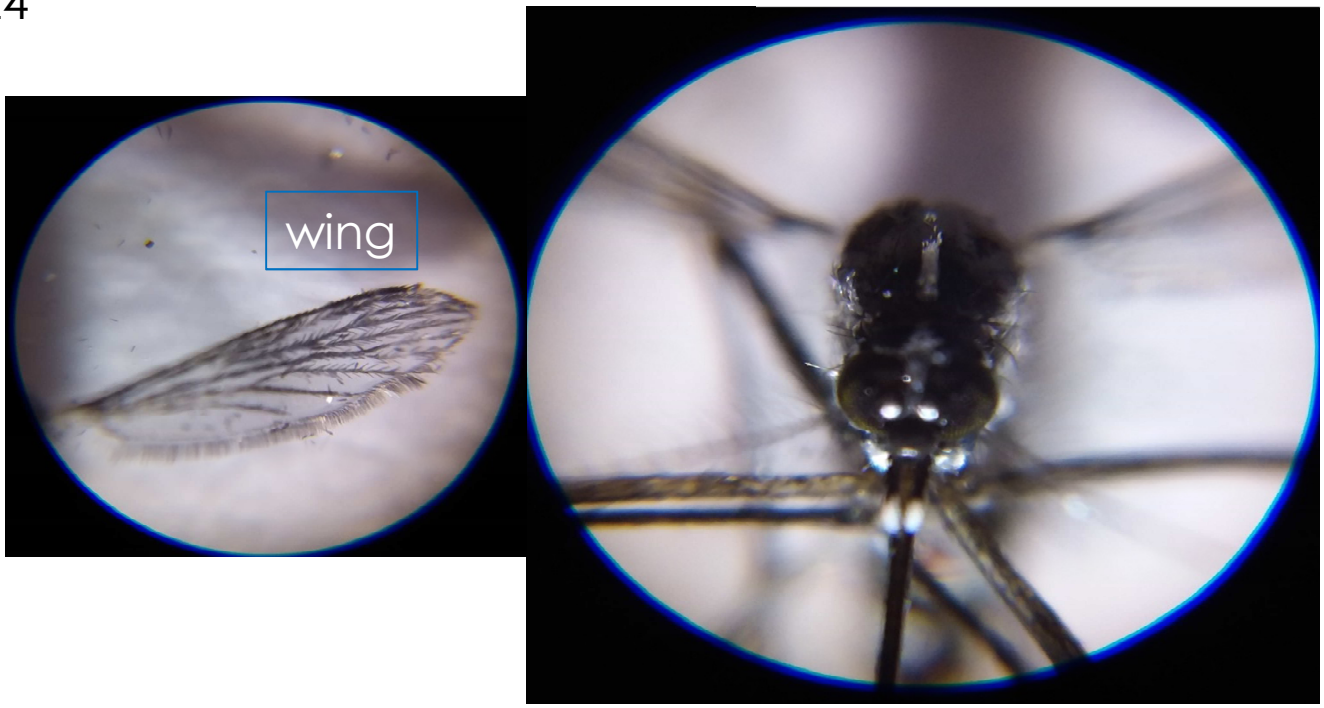

Adult of *Aedes albopictus*

On 08th March 2020 , 5 emergent Adults of *Aedes albopictus* are collected from artificial container

RESEARCH RESULTS SHARED

Examples of results shared /GLOBE O Clouds

DATA GLOBE OBSERVER CLOUDS
Latitude –19.8535
Longitude 47.0336

Date/Time (UTC): **10/24/2019 09:47:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **-19.8535, 47.0336 (-19° 51' 12.6", 47° 2' 0.96")**

Organization: **Madagascar Citizen Science**

Site Name: **38KQD129034**

MUC Code: **91**

MUC Description: **Urban, Residential Property**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: No; Raining/Snowing: No**

North Classifications: **50% MUC 43 [Herbaceous/Grassland, Short Grass]; 50% MUC 91 [Urban, Residential Property]; 40% MUC 93 [Urban, Roads and Parking]; 20% MUC 81 (2) [Cultivated, Orchards]**

East Classifications: **50% MUC 43 [Herbaceous/Grassland, Short Grass]; 60% MUC 91 [Urban, Residential Property]; 30% MUC 93 [Urban, Roads and Parking]; 20% MUC 81 (2) [Cultivated, Orchards]**

South Classifications: **20% MUC 43 [Herbaceous/Grassland, Short Grass]; 80% MUC 91 [Urban, Residential Property]; 50% MUC 93 [Urban, Roads and Parking]**

West Classifications: **40% MUC 43 [Herbaceous/Grassland, Short Grass]; 30% MUC**

Date/Time (UTC): **10/21/2019 08:57:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **-18.9039, 47.5271 (-18° 54' 14.04", 47° 31' 37.56")**

Organization: **Madagascar Citizen Science**

Site: **38KQE662079**

Total Sky
- Cloud Cover: **Scattered (25-50%)**
- Sky Color: **Blue**
- Sky Clarity: **Somewhat Hazy**

High Level Clouds (not observed)

Mid Level Clouds
- Cloud Types: **Altocumulus**
- Cloud Cover: **Scattered (25-50%)**

Low Level Clouds
- Cloud Types: **Stratus**
- Cloud Cover: **Scattered (25-50%)**
- Opacity: **Opaque**

Surface Conditions: **Leaves on Trees**

Show on Map

Date/Time (UTC): **10/24/2019 09:47:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **-19.8535, 47.0336 (-19° 51' 12.6", 47° 2' 0.96")**

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We are very proud to be GLOBE OBSERVER

(Valery Riantsoa ' s efforts)

ZIKA GLOBE FORMATION
MADAGASCAR on 2019

Thanks to GLOBE

DISCUSSION

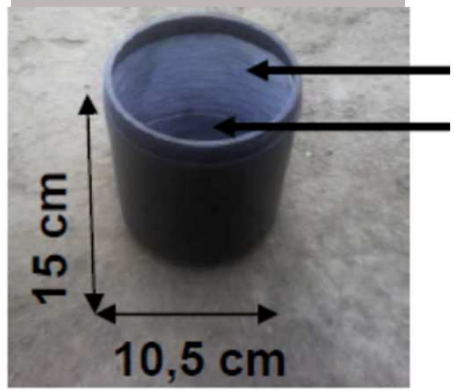
The entomological surveillance of Aedes pemits to follow the evolution of the density of A. albopictus and to issue an epidemiological alert
This system includes: adult supervision, eggs monitoring and surveillance of larvae and pupae

Preliminary results of Surveillance of larvae and pupae are reported here during rainy season 2020 and the team still continued the task.

Adult supervision is initiated .

Eggs monitoring has to be shared to GLOBE schools at Madagascar soonly.

Eggs monitoring using Ovitrap



Using android device for GLOBE OBSERVER and Pocket microscope had permited those some results
We don't find appication for sharing rainfalls data .

CONCLUSION

These some results show that a rise in temperature and precipitation precede an adult outbreak.

The breeding sites are very productive

The entomological indices allowed predicting a risk of transmission of arboviruses in this sector.

Continuation :

Monitoring protocol of *Aedes Albopictus* developed for GLOBE schools:

-surveillance of eggs

- surveillance of larvae and pupae

- surveillance of adults

Protocols larvae , pupal and eegs can be usable by all levels of Schools GLOBE

Surveillance of adults is for UG and high school levels .

These efforts promote research in *A.albopictus* studies