2021 International Virtual Science Symposium

Minas Gerais School Science Club: Luis Eduardo Cordeiro Freitas, Gabriel Ferreira Moraes, Mariana da Rocha Brito de Sousa, Manuela da Rocha Brito de Sousa, Dora Fogaça Stover, Bento Fogaça Stover, Julia Witt, Miguel da Silva Palmieri. **Alumni:** Juliana Villela.

School: Minas Gerais Public School.

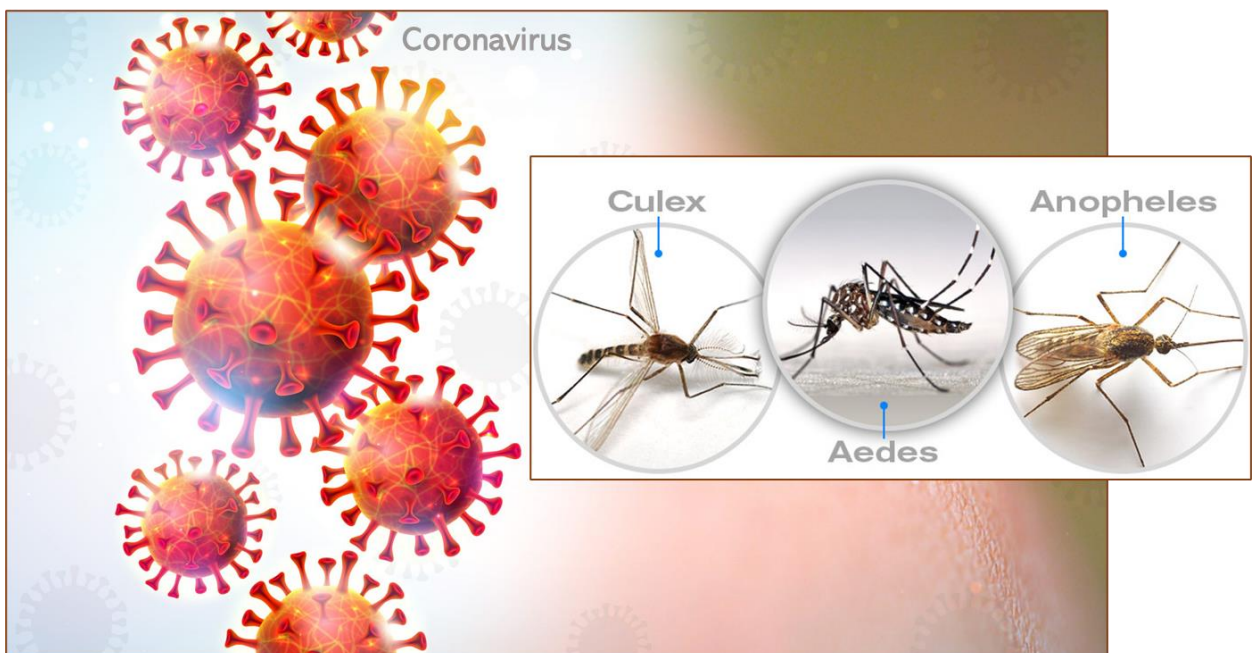**1. TITLE: The diseases transmitting mosquitoes do not enter in quarantine!**

Figure 1. Coronavirus and the three Main mosquito vectors of diseases

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2. ABSTRACT

The main objective of GLOBE is to get citizens involved in scientific research and the protection of Earth's systems, through the analysis of data collected in the field to answer questions about climate change and unplanned urbanization impacts on the environment.

But how to collect data from disease-transmitting mosquitoes in quarantine from the COVID-19 pandemic, and what genus of mosquitoes is most frequent in our homes?

This study investigates the possibility of students collecting mosquito data using homemade mosquito traps, with reused material, such as PET bottles, in a safe way, ensuring the quarantine, within their own homes, and in this way, respecting the health rules to prevent COVID-19. To observe the larvae of the traps, students used the Globe Observer mosquito habitat mapper (MHM). The students could collect, count, identify and send data to the GLOBE platform using the MHM app. After the data collection of the mosquito trap was completed, the water was safely disposed of and the traps were rebuilt for new mosquito data collection.

It is important to remember that mosquitos are the most dangerous animal in the world because they can transmit diseases such as dengue, urban yellow fever, chikungunya, and zika virus. We also ask a question about which genus of the mosquito is the most frequently found in students' homes during the coronavirus pandemic.

It was possible to verify during the data collection period of the capture traps (traps for transparent 1.5 L PET bottles with fish food), between August 2020 and February 2021, using the Globe Observer MHM app, that there were security and respect to sanitary measures to prevent COVID-19, since students were quarantined in their own home.

Answering the other question made in this study: The genus of mosquitoes most frequently found in our homes during the pandemic time was *Aedes*.

Keywords: *Aedes*, capture traps, homes, COVID-19, mosquito diseases, quarantine, Globe MHM.

3. RESEARCH QUESTION AND HYPOTHESIS

Question

How to collect data from disease-transmitting mosquitoes in quarantine from the COVID-19 pandemic, and what genus of mosquitoes is most frequently found in our homes?

Figure 2. Mosquito trap quarantine challenge.

Hypothesis

Students can collect data and develop studies about the presence of disease-transmitting mosquitoes in their homes with mosquito homemade traps, safely and respecting the quarantine and all health rules to prevent COVID-19. For the data collection, students use the Globe Observer MHM app and Globe platform for data visualization. By identifying the genus from the mosquito larvae in the research, it could be discovered that most of the mosquitoes found are of the Aedes genus, since the genus Aedes is the most common at this time of year, as can be seen in previous research.

4. INTRODUCTION (Research History)
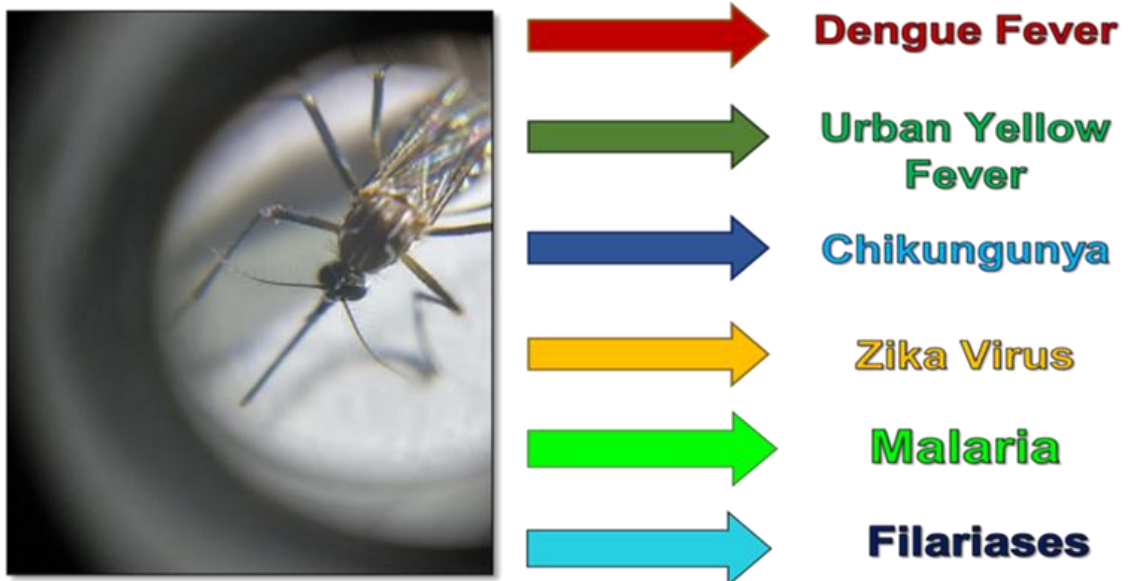
Figure 3. *Photo by Minas Gerais' science club student – Luis Eduardo Freitas)*

Mosquitoes are commonly known for posing a significant threat to public health. They are the most dangerous animals in the world: mosquitoes carry diseases that kill one million people a year. More than a hundred species of mosquitoes can transmit various diseases to humans and other animals, such as malaria, dengue, zika virus, chikungunya, and urban yellow fever. There is a major ongoing effort to eliminate mosquito breeding sites.

Aedes aegypti is an urban mosquito, native to tropical and subtropical regions, and does not survive the low temperatures present at high altitudes. *Aedes aegypti* transmits dengue, chikungunya, and zika virus. It is a smaller mosquito than the common ones, black with white stripes on its trunk, head, and legs, with translucent wings. The male, as of any species, feeds exclusively on fruits. The female, however, needs blood to mature her eggs, which are deposited separately on the inner walls of objects, near standing water surfaces, a place that offers them better survival conditions: heat and precipitation.

'GLOBE 'is an Environmental Education and Science program sponsored by NASA and supported by space agencies and educational institutions in more than 120 countries. The main objective of GLOBE is to involve citizens in scientific research and the protection of Earth's systems, through the analysis of data collected in the field to answer questions about climate change and unplanned urbanization impacts on the environment.

But how to carry out efforts and projects in times of pandemic, trapped in our homes?

This is the challenging theme of the Minas Gerais Municipal School Project in 2021.

What is COVID-19?

What Is COVID-19?

Coronavirus disease 2019 (COVID-19) – 'CO' stands for corona, 'VI' for virus, and 'D' for disease – is a disease caused by a new type of coronavirus first identified in Wuhan, China. Many COVID-19 symptoms are similar to those of the flu, the common cold and other conditions, as headache, loss of taste or smell, sore throat, congestion or runny nose, so a test is required to confirm if someone has COVID-19. Symptoms may appear 2 to 14 days after exposure to the virus and can range from very mild to severe illness. Some people who have been infected don't have any symptoms.

How does the COVID-19 virus spread?

The virus is spread mainly when respiratory droplets from an infected person (generated through coughing, sneezing, talking, singing) get into the mouth, nose or eyes of people who are nearby. The COVID-19 virus may also survive on surfaces, although simple disinfectants can kill it.

Based on what we currenttransmission of COVID-19 is primarily occurring from people when are in proximity with others tly know, for prolonged periods of time. – particularly in poorly ventilated, crowded indoor spaces, where people who are infected are spending extended periods of time close to others.

How can I protect myself and others from COVID-19?
TOP FIVE PROTECTION

1. Wash your hands frequently using soap and water or an alcohol-based hand rub.
2. Wear fabric masks when in public.
3. Make quarantine!
4. Avoid crowded places and try to practice physical distancing from people in public.
5. Keep all indoor spaces well ventilated.

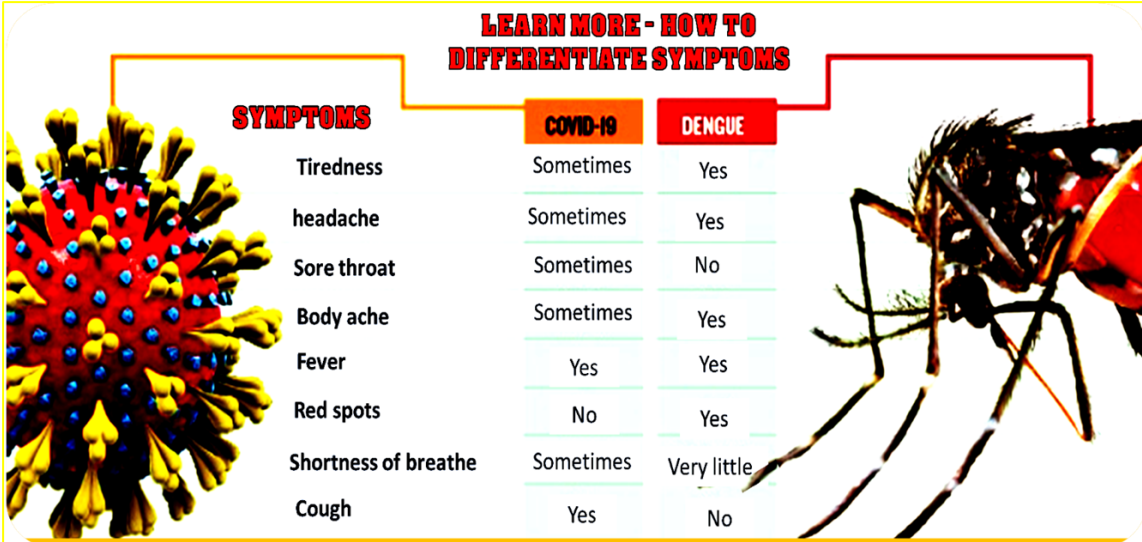SOURCE: www.unicef.org/stories/novel-coronavirus-outbreak-what-parents-should-know

COVID-19 pandemic puts the fight against the *Aedes aegypti* mosquito at risk

Mask on the face, yes, but repellent on the body, too, and constant vigilance, even more. The increase in the number of deaths caused by the new coronavirus, which surpassed the deaths caused by dengue in Brazil, triggers an alert that masks another, a silent one: the constant threat of diseases transmitted by the mosquito *Aedes aegypti*, old acquainted to the population, but relegated to the background because of the concerns about the advance of COVID-19.

More people are at home due to the recommendations of social isolation, but the concern about the mosquito, and especially about dengue, cannot be left aside. The disease has killed more than 180 people in the country in the first months of the year. In this context, leaving standing water can create another problem for the health system, along with the already complex scenario of the battle against the new coronavirus. Experts point out that the fatality rate of COVID-19 is much higher, and the virus is faster in transmission terms, compared to those transmitted by *Aedes aegypti*. However, isolation without the already practiced care against the mosquito may favor the proliferation of the vector, which also transmits chikungunya and zika. In addition to overloading the health care system, which also faces other respiratory diseases at this time of year. (https://www.medicina.ufmg.br)

I'm sick, do I have dengue or COVID-19?

See how to differentiate the symptoms of the two diseases. But always seek medical advice.

SYMPTOMS	COVID-19	DENGUE
Tiredness	Sometimes	Yes
headache	Sometimes	Yes
Sore throat	Sometimes	No
Body ache	Sometimes	Yes
Fever	Yes	Yes
Red spots	No	Yes
Shortness of breathe	Sometimes	Very little
Cough	Yes	No

Faced with this problem, the eradication of mosquito diseases and their prevention through measures to combat mosquitos' transmitters demand the participation and mobilization of all the community. The school as a space for health education is a powerful tool for disseminating

information to the entire community, guiding the population on how to act in the fight against this vector. But what can you do from home?

Minas Gerais science club decided, in online meeting, to do monthly challenges to collect data using the Globe Observer MHM app. For the challenges, we use homemade security traps placed in students' homes to catch mosquitoes, thus respecting the COVID-19 quarantine.

Taking advantage of the fact that some disease-transmitting mosquitoes have an urban habit, students used these traps inside their homes to safely collect, count, and identify disease-transmitting mosquitoes, respecting quarantine, following health regulations to prevent the COVID-19, such as using fabric masks and public isolation.

The capture traps were placed in dark corners of the houses, simulating the preferred habitat of mosquitoes of the *Aedes* genus - tires.

The data collection period using capture traps was from August 2020 to February 2021, using the Globe Observer MHM app. The dominant genus found in mosquito traps is *Aedes*.

When the data collection of mosquitoes from the capture traps at the students' home was completed, the water was safely discarded and, when possible, the trap was rebuilt for new mosquito data collections.

Minas Gerais science club is collecting data with mosquito capture traps using different kinds of food for larvae, different types of water, and covering traps with dark and light color fabrics in a safe, continuous, and correct scientific investigation in pandemic times.

Figure 4. *How do make* a *captive trap*

5. MATERIALS AND METHODS

Study area:

Figure 5. Location of the study site in five districts in Rio de Janeiro County, RJ/ Brazil.

The city, and also the entire state of Rio de Janeiro, is completely inserted in the Atlantic Forest. The climate of the Atlantic Forest is predominantly humid tropical, influenced by the humid air masses that come from the Atlantic Ocean. Its average temperatures and air humidity are high throughout the year and the rains are regular and well distributed. Thus, the climate of Rio de Janeiro varies according to the region of the state and its proximity to the sea, and the average annual temperature is 24 °C. In general, rainfall is abundant in the state.

(https://escolaeducacao.com.br/geografia-do-estado-do-rio-de-janeiro/)

The study sites were located in the houses of six students from Minas Gerais Science Club in six different locations (addresses), within five districts, in Rio de Janeiro County, RJ/ Brazil. (Figure 5). The research was conducted from August 2020 to February 2021.

LOCATIONS' COORDINATES: (MHM)

-Copacabana 1 - 22°57'34'' S / 43°11'14''W   -Copacabana 2- 22°57'29'' S / 43°10'31''W

-Catete - 22°55'41'' S / 43°10'59''W   -São Cristóvão - 22°57'34'' S / 43°11'14''W

-Humaitá - 22°95'84'' S / 43°19'92''W   -Botafogo- 22°52'24'' S / 43°13'21''W

OBSERVATIONS WERE MADE USING:

Materials

- Homemade capture traps (transparent 1,5 L PET bottle traps filled with fish food) for mosquito larvae.
- GLOBE Collection Kit for mosquito larvae identification (cell phone microscope, plastic plate, toothpick, tweezers, test tube etc.).
- Graphics elaborated by students according to the GLOBE data platform.
- MHM – GLOBE Observer - Mosquito Habitat Mapper app.
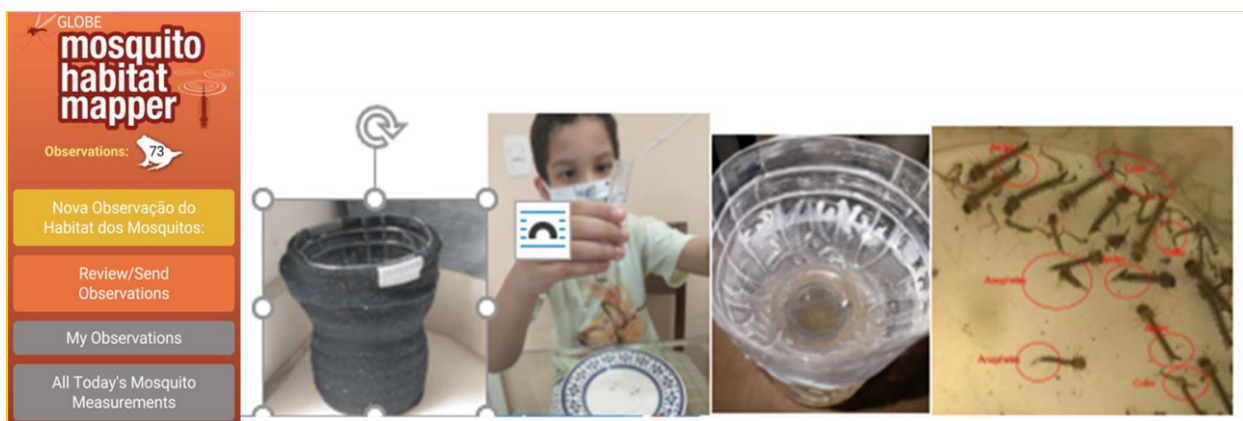
Figure 6. Student collecting data, identifying genus using the GLOBE Mosquito Habitat Mapper app (MHM)

Research Methods

- Safely using mosquito capture traps inside students' homes during quarantine and mosquito challenges to collect, count, and identify disease-transmitting mosquitoes using the GLOBE identification protocol for mosquito larvae.
- That way, the students are at home safely and respecting the quarantine and all sanitary rules for preventing COVID-19.
- The experiment was carried out in six locations (addresses), within five districts in Rio de Janeiro County, RJ/ Brazil.
- Capture traps (transparent 1,5 L PET bottle traps) filled with fish food were installed to capture the larvae of mosquito whose female is the main transmitter of diseases: dengue, chikungunya, and zika.
- These traps were monitored monthly at first, and after December, biweekly. The method used for data collection and research was the GLOBE Mosquito Habitat Mapper (MHM) app, which helped to identify the larvae from mosquitoes carrying these deadly diseases.
- Our research was conducted from August 2020 to February 2021.

- Remembering that zero is always important, as it determines the appearance/return of the mosquito to the studied areas.

Data Summary and Analysis

An important part of this research was the possibility to collect, treat, and visualize the mosquito data, since the students were not able to be in the field and had to remain safely in their homes to avoid COVID-19. To collect data, it was required some specific tools: for mosquito data, we used the GLOBE Mosquito Habitat app, the mosquito larvae hydrology protocols, the GLOBE mosquito identification kit, and the GLOBE website as tools for data visualization and graphics production.

The research collected data from larvae traps (transparent 1,5 L PET bottle traps filled with fish food) in six locations (addresses), within five districts, in Rio de Janeiro County, RJ/ Brazil. (Figure 5). The research was conducted from August 2020 to February 2021.

The research compared data from larvae traps (transparent 1,5 L PET bottle traps filled with fish food) at Minas Gerais School from August 2020 to February 2021 and the same period of 2018/2019, using data that had been collected during our previous projects, stored in the GLOBE data platform.

By identifying the genus from the mosquito larvae in the research, it was found that most of the mosquitoes encountered are of the *Aedes* genus.
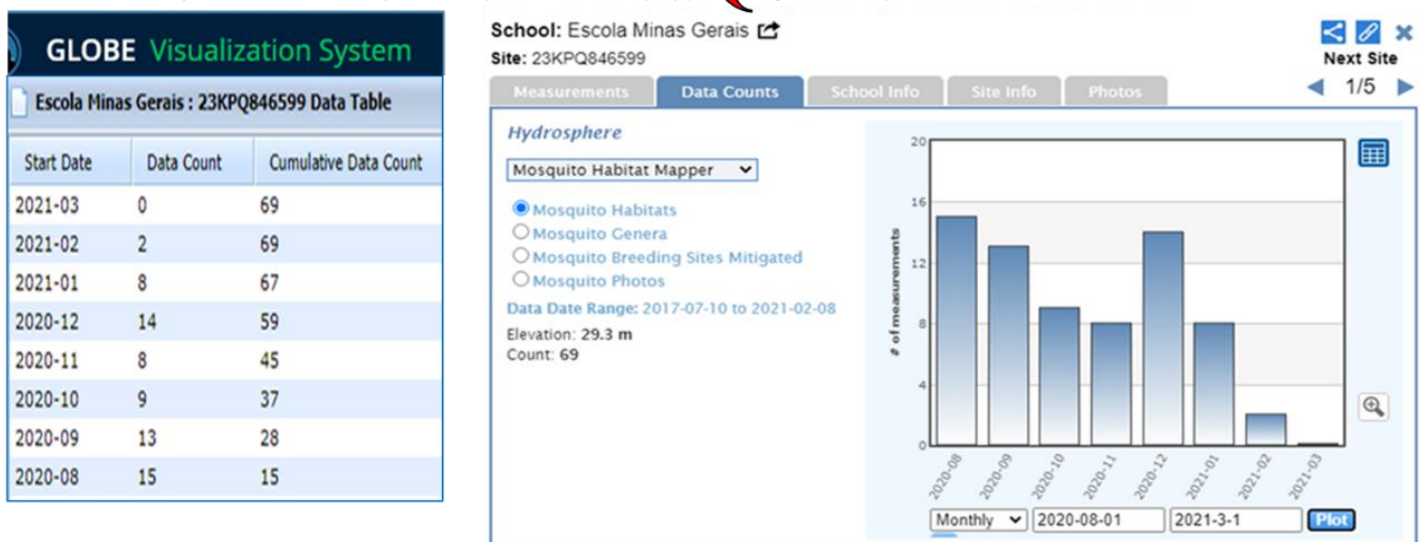

Figure 7. Data collected from mosquito habitat (capture traps) - August 2020 to February 2021- E.M. Minas Gerais – Globe Observer –MHM app – Source: globe.gov
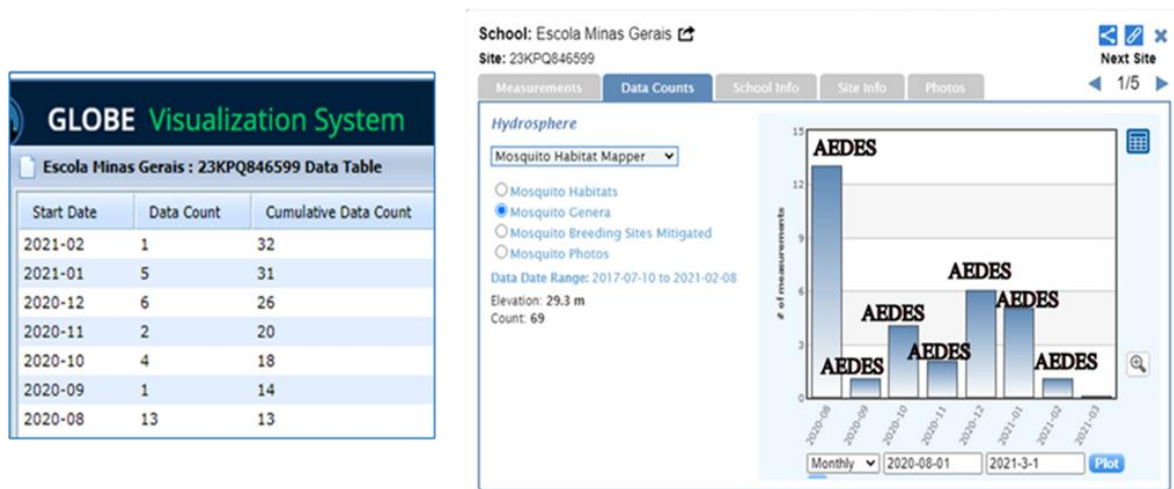
INCIDENCE OF MOSQUITO GENUS 2020/2021

Figure 8. Data collected from mosquito genus (capture traps) - August 2020 to February 2021- E.M. Minas Gerais – Globe Observer –MHM app – Source: globe.gov

6. RESULTS

The habitats data was collected by the GLOBE Mosquito Habitat Mapper app and it was possible because the students wanted to be part of the challenges and collect data in coronavirus quarantine times, using homemade capture traps. The capture traps were put inside the homes of six students in five different districts in Rio de Janeiro City, from Aug / 2020 until Feb / 2021.

The graphic of figure 7, shows, in the habitat data collected by the MHM app, a higher positivity of mosquitoes in the capture traps in students 'homes in pandemics times.

The graphic of figure 8, shows, in the genus data collected by the MHM app, a positivity of genus *Aedes* in the capture traps in students 'homes in pandemics times.

In the data collected by the Globe Mosquito Habitat Mapper app, was found possible a higher incidence of mosquitoes in capture traps in the six districts, from August / 2020 to Feb / 2021 in comparison to the same period in 2018/209 (when we were not in quarantine).

Our results support our hypothesis

The isolation without the already practiced care against the mosquito may favor the proliferation of the vector, which also transmits dengue, chikungunya and zika. In addition to overloading the health care system, it also faces other diseases at this time of the year.

In this perspective, our research and results were very relevant and have made us support our hypothesis that students can collect data and develop studies and research for the presence of disease-transmitting mosquitoes in their homes, with mosquito capture traps, safely and respecting

the quarantine and all health rules to prevent COVID-19. For the data collection, the students use the Globe Observer MHM app and the Globe platform for data visualization (figure 7).

By identifying the genus from the mosquito larvae in the research, it was discovered that most of the mosquitoes found are of the *Aedes* genus (figure 8) since the genus *Aedes* is the most common this time of year, it as can be seen in previous research as shown in the graph in figure 9.
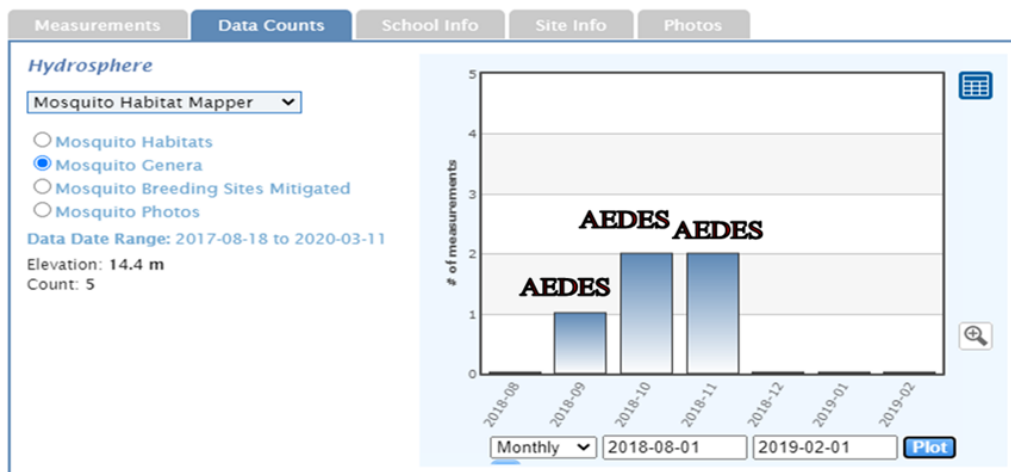
Figure 9 - *Data collected – mosquito genera from August 2018 to February 2019 by E. M. Minas Gerais - SOURCE: globe.gov*

7. DISCUSSION

The main objective of GLOBE is to get citizens involved in scientific research and the protection of Earth's systems, through the analysis of data collected in the field to answer questions about climate change and unplanned urbanization impacts on the environment.

The collection of data in coronavirus quarantine times was a real challenge, since face-to-face classes were suspended, students were placed in quarantine, and GLOBE projects were suspended.

The students accomplish monthly challenges to collect data using homemade capture traps in their own homes following the health regulations for preventing COVID-19, as remaining in quarantine and using fabric masks.

We performed the analysis and interpretation of the results found through comparative graphics, spreadsheets from GLOBE, and reports of incidence of diseases in the Municipal Health Department.

In Brazil, *Aedes aegypti* larvae research is used to calculate the level of mosquito infestation and, therefore, to estimate the risk of disease epidemics, as recommended by the World Health Organization. In order to do so, traps (transparent 1,5 L PET bottle traps filled with fish food) are

used to develop larvae mosquitoes, in the monitoring and control of mosquitoes that transmit dengue, chikungunya, and zika – genus *Aedes*.

It was observed, in the data collected by the GLOBE Mosquito Habitat Mapper app, a higher positivity of mosquitoes (number of larvae) in the capture traps (transparent 1,5 L PET bottle traps filled with fish food), from August / 2020 to February / 2021 (period of quarantine) in comparison to the same period of the previous year (Figure 8 and 9).

Rainy days, moist areas, and residential districts (communities) inside the Tijuca Forest and near the Massif of Tijuca, from the Rio de Janeiro location, can contribute to the proliferation of the *Aedes* mosquito. In the samples, all mosquitos 'larvae founded were of the *Aedes* genus (Figure 8,11 and 12). Remembering that zero is always important, as it determines the appearance/return of the *Aedes* mosquito to the studied areas.

Figure 10- *Some students homes and other houses in communities inside Tijuca Forest and Massif of Tijuca.*

8. CONCLUSION

The results of our research support our hypothesis that it is possible to collect data on mosquitoes that transmit the diseases: yellow urban fever, dengue, zika virus, and chikungunya, among others, in mosquito traps challenges during the quarantine of COVID-19, safely following health protocols and quarantine, in times of coronavirus pandemic.

We saw that it is possible to collect data, count, and identify the genera of disease-transmitting mosquitoes using capture traps, built with reused materials, such as PET bottles and other homemade utensils, to analyze mosquito larvae, inside the homes of the students involved in the project. This way, remaining safe and respecting health rules against coronavirus. We must not forget what experts point out, the fatality rate of COVID-19 is much higher, and the virus is much

faster in transmission terms, compared to those transmitted by *Aedes aegypti.* However, isolation without the already practiced care against the mosquito may favor the proliferation of the vector.

Figure 11 and figure 12*- Data collected – mosquito genera collect from homemade traps from August 2018 to February 2019 by E. M. Minas Gerais - SOURCE: globe.gov*

We concluded and proved that it is possible to collect, count, and identify the genus of disease-transmitting mosquitoes safely in times of the COVID-19 pandemic, using mosquito captive traps placed inside students' homes and thus respecting sanitary rules and after collecting data send them using the GLOBE Observer Mosquito (MHM) application on the GLOBE program platform.

In the samples, all of the mosquito larvae were of the *Aedes* genus (Figure 8, 11 and 12).

9. ACKNOWLEDGEMENTS

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11. OPTIONAL BADGES FOR SCIENTISTIC SKILLS

Collaboration

All the students worked together to provide good work. During the development of the project, each of the students could stand out in their best performance. Therefore, they were able to show their specials skills.

- Luiz Eduardo Freitas: data collection, project summary, video elaboration, theoretical part, and research on the subject.
- Julia Witt, Dora Fogaça Stover, Mariana da Rocha Brito de Sousa, Manuela da Rocha Brito de Sousa: collection and production of utilizable data and manufacture the capture traps.
- Luiz Eduardo Freitas, Miguel Palmiere, Bento Fogaça Stover: art and preparation of the video.
- Luiz Eduardo Freitas and Alumni Juliana Villela: Video Presentation.

Community impact

The year 2020 will be remembered for the new coronavirus pandemic- in the city of Rio alone, there have been more than 9 thousand deaths and 100 thousand confirmed cases of the disease.

Other pathologies, however, registered a decrease: it is the case of significant reductions in the numbers of cases of zika, dengue, and chikungunya.

Within the data collection period using the Globe Observer MHM, the City of Rio de Janeiro registered a drop of up to 99.3% in cases of chikungunya, compared to the same months of 2019.

According to an evaluation by the Municipal Health Secretariat, the period of social isolation to contain the spread of the new coronavirus helped to fight mosquito-borne diseases, mainly of the *Aedes* genus. Although the numbers show a drop, experts warn that the care to avoid breeding grounds for the *Aedes Aegypti* mosquito, which transmits dengue, chikungunya, and zika, must continue.

Thinking in this perspective, our research that collected mosquito data to detect the presence of disease-transmitting mosquitoes in our homes, using mosquito captive traps, in a safe way during the coronavirus pandemic, was very relevant.

I am a data scientist

We are GLOBE students and therefore we think of scientific research as a means of collecting data, to help solve problems and, this way, better understand and help improve the terrestrial environment at local, regional, and global scales, by feeding the GLOBE database. Therefore, taking advantage of the fact that some disease-transmitting mosquitoes have an urban habit, students used mosquito traps inside their homes, to safely collect, count, and identify disease-transmitting mosquitoes, respecting quarantine and following health regulations for preventing COVID-19, such as the use of fabric masks.

The capture traps were placed in dark corners of the houses, simulating the preferred habitat of mosquitoes of the genus *Aedes* - tires -, mosquitoes that transmit diseases such as urban yellow fever, dengue fever, zika virus, chikungunya, and *Culex* transmitter of filariasis, among others. The GLOBE Mosquito Habitat Mapper was the app used in the Project.

Exploring STEM Careers

The use of the GLOBE Mosquito Habitat Mapper used in the Project, allowed the visualization of geographic information, as well as performed data collection in the field, by using the GPS functionality of the mobile terminals to provide location intelligence in mapping projects. The data collected and recorded, along with all field documentation of possible habitat, genus identification, mosquito species, and the destruction of breeding sites, help students and scientists to investigate more effectively and more promptly the proliferation of enemies, supporting our battle against mosquitoes of diseases such as dengue fever, yellow fever, chikungunya, and the zika virus.