# Exploring the Impact of different wavelengths of light on the attraction of mosquito trap bycatch.

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## Abstract

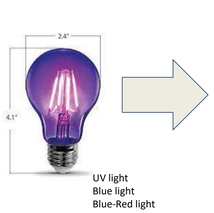
The experiment aims to find the most efficient strategy to keep mosquitoes away from humans by testing the attraction of different species to various LED lights while minimizing the by catch of beneficial insects. With the use of LED lights, the control of colors is much easier, therefore providing more chances to find colors that will increase rates of insect trapping.
The experiment was done using the same environment and time to prevent variables, and the goal is to determine the possible impacts of an increased use of LED lights on mosquito attraction. Mosquitoes carry lethal diseases, and finding effective mosquito trapping methods is essential to protect humans.

## Materials & Methods

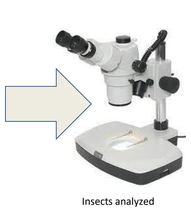

Mosquito Traps


Trap opened

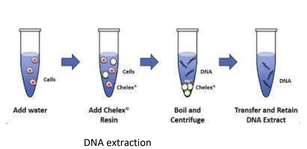

Trap closed


UV light
Blue light
Blue-Red light

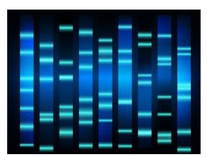

Insects frozen to humanely kill insects


Insects analyzed

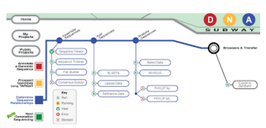

Pictured taken


DNA extraction


PCR


Gel electrophoresis


Sequencing by Genewiz


DNA Subway

## Results

In order to know if the PCR was successful, gel electrophoresis was completed. As shown in figures 2-4 below. Samples that successfully went through this process were sent into CSHL to be sequenced. The results show that the different wavelengths of light did have an effect on the biodiversity of insects caught. Figure 1 shows that the UV light attracted the most insects, and had the greatest biodiversity of insects, the fluorescent light trap caught the least amount of samples. The blue light trap caught the second most amount of insects. All samples were run through DNA Subway to see how many mismatches there were between the samples collected and the samples in the database. Most samples had little to no matches in the NCBI database, which means these samples caught are unique to the bohemia area. (Reference figure 9)

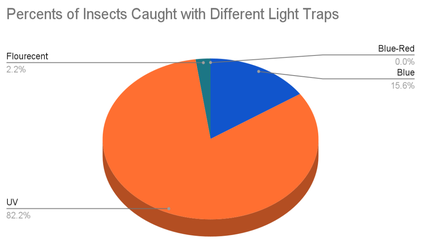


Chart1: Pie Chart of The Effect Of Different Lights


Chart 2- Picture of CPM-017

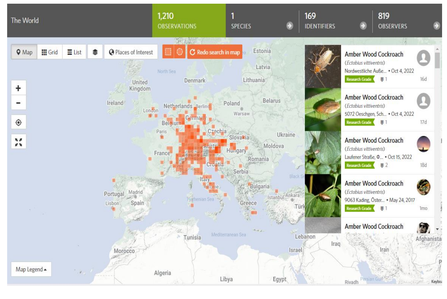


Chart 3- Locations of the Last Barcoded Woody Cockroach

## Introduction

- Mosquito traps have the potential to harm the environment by catching not only mosquitoes but also other organisms, including beneficial ones that support ecosystems and humans.[3]
- Invasive species, which can be inadvertently caught by traps, can cause damage to native species and offset the balance of ecosystems.[3]
- The use of different wavelengths of light in mosquito traps can attract various species and quantities of insects, some of which may be beneficial or harmful.
- DNA barcoding can be used to identify the species caught and determine their impact on the environment. This barcoding technique has a higher capability to specify the samples barcoded. Barcodes are simpler and much more specific than looking through a microscope to an average person.

## Discussion

- UV light attracts the most insects compared to the other lights tested in this experiment.
- Our data suggests that being towards the left or purple side of the bright line spectrum has a greater influence on the attraction of insects. “Insects can perceive light in the 300-650 nm range, but prefer light that is between 300-420 nm which includes UV light.”[9]
- One interesting factor is the genetic difference between every gall midge sample barcoded. The midges caught were similar to each other but very different from the samples most like in the NCBI database.
- The Woody cockroach, genus name of Ectobius (figures 7-8), from the Eastern Hemisphere was like this as well. For all Ectobius samples there were little to no samples that matched our samples in the NCBI database.
- One shortcoming we faced was that on one of the traps, the net was ripped, which forced us to make a makeshift replacement.
- The majority of the insects were not mosquitoes, but instead a variety of different insect species.
- Some improvements that could be done in the future would be further research on catching the targeted species of insects, which reduces the amount of bycatch also.
- Another improvement that could be made is testing out equipment that is needed for the experiment before the experiment is being conducted, so there can be less human error.
- The use of UV lights in mosquito traps can be harmful to the environment which can be concluded from our experiment due to the fact that a minimal number of mosquitoes were caught while a majority of the collection were other insects. By catching these insects it can disturb the ecosystem as these insects can be food for other animals in the environment.

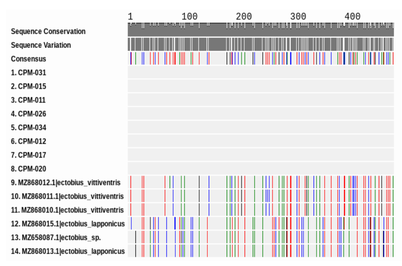


Chart 4-DNA Sequence of all Cockroaches Barcoded

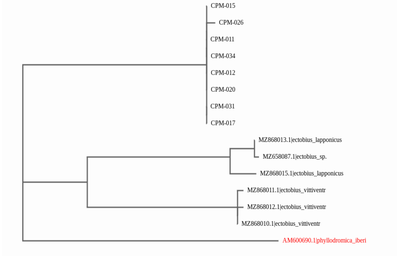


Chart 5- Hereditary Tree Chart of Cockroaches Barcoded

| | |
|---|---|
| CPM-045 | OQ954917 |
| CPM-039 | OQ954916 |
| CPM-034 | OQ954915 |
| CPM-031 | OQ954914 |
| CPM-029 | OQ954913 |
| CPM-026 | OQ954912 |
| CPM-020 | OQ954910 |
| CPM-021 | OQ954911 |
| CPM-018 | OQ954909 |
| CPM-017 | OQ954908 |
| CPM-015 | OQ954907 |
| CPM-012 | OQ954906 |
| CPM-011 | OQ954905 |
| CPM-008 | OQ954904 |
| CPM-007 | OQ954903 |
| CPM-005 | OQ954902 |
| CPM-004 | OQ954901 |
| CPM-003 | OQ954900 |
| CPM-002 | OQ954899 |

Chart 6- Published Samples

## References

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8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5108255/

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