How to catch mosquitoes and its preferences for temperature and carbon dioxide

LUO, XIN YI     HUANG, YU CHIN     LIU, YU HSUAN
Teacher ： CHEN, CHENG CHANG
Hsin Tien Senior High School
Taiwan
2022/03/07
Abstract:

Since the first year of high school participated in the science fair, we decided to study this related topic. The main research is to observe the effects of temperature, color and taste on mosquitoes. This report will describe all of our research processes.
Research Question and Hypothesis:

1. We assume that mosquitoes move to warmer places.
2. We hypothesize that CO2 is attractive to mosquitoes.
Introduction and Review of Literature:

• Abstract
• Research Question and Hypothesis
• Research Methods and Materials
• Results
• Discussion
• Conclusion
• Bibliography/Citations
• Badge Descriptions/Justifications
Research Methods and Materials

catch experiment target

1. Raised after catching mosquitoes.
2. Catch mosquitoes
3. Place artificial water.
1. Raised after catching mosquitoes.

Idea:
Initially, we wanted to observe larvae. But the larvae we catch quickly turn into mosquitoes, so we instead observe mosquitoes.

Location:
School Ditch.

Materials:
insect box, plastic spoon, dropper, plastic container.

step:
1. Fishing for water and larvae in ditch.
2. Remove larvae with a spoon and dropper into the bug box.
• Capture results

<table>
<thead>
<tr>
<th>date</th>
<th>mosquitoes</th>
<th>pupa</th>
<th>larvae</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/12</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2/13</td>
<td>1</td>
<td>0</td>
<td>51</td>
</tr>
<tr>
<td>2/14</td>
<td>1</td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td>2/15</td>
<td>2</td>
<td>41</td>
<td>9</td>
</tr>
<tr>
<td>2/16</td>
<td>14</td>
<td>38</td>
<td>0</td>
</tr>
<tr>
<td>2/17</td>
<td>41</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>2/18</td>
<td>52</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
- keep mosquitoes

<table>
<thead>
<tr>
<th>Materials</th>
<th>LIU, YU HSUAN</th>
<th>LUO, XIN YI</th>
<th>HUANG, YU CHIN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Erlenmeyer flask</td>
<td>Plastic wrap paper tape</td>
<td>Toilet paper rubber bands</td>
</tr>
<tr>
<td></td>
<td>rubber stopper</td>
<td>insect box</td>
<td>transparent plastic cups</td>
</tr>
<tr>
<td></td>
<td>water.</td>
<td>Erlenmeyer flask</td>
<td>Erlenmeyer flask</td>
</tr>
<tr>
<td></td>
<td></td>
<td>honey water.</td>
<td>honey water (honey: water=2:1)</td>
</tr>
<tr>
<td>Mosquito causes of death</td>
<td>• no food</td>
<td>• Honey water get mouldy.</td>
<td>• Accidentally fly away when opening lid.</td>
</tr>
<tr>
<td></td>
<td>• no air</td>
<td>• Accidental shaking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• No activity space</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bottle shakes easily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>advantage</td>
<td>• Easy to carry.</td>
<td>• have food</td>
<td>• have air</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ample activity space</td>
<td>• have food</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• have air</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Keep mosquitoes
LIU, YU HSUAN

seal with rubber stopper
- space of mosquito (air)
- space of larva (water)

cover with toilet paper
- no cover
- honey water (honey : water = 2:1)

space of mosquito
- transparent plastic box
- no cover
- honey water (get mouldy)

space of larva

HUANG, YU CHIN

LUO, XIN YI
result:

A total of 52 larvae were caught. According to the observation, we found that it only took one to two days for the larvae to turn from pupae to mosquitoes.

Because we have artificial reasons to cause the mosquitoes we raise to die.
2. Catch mosquitoes.

Idea:
Skip raising the larvae and go straight to the ready-made mosquitoes.

<table>
<thead>
<tr>
<th>Location</th>
<th>Plan A</th>
<th>Plan B</th>
<th>Plan C</th>
</tr>
</thead>
<tbody>
<tr>
<td>School ditch</td>
<td>Two of toilets in school</td>
<td>Playground and recycling room</td>
<td></td>
</tr>
<tr>
<td><strong>How mosquitoes appear</strong></td>
<td>Flying 4cm off the ground along the ditch.</td>
<td>Staying at wall, door or ceiling.</td>
<td>Flying near people.</td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>Transparent plastic cups</td>
<td>Transparent plastic cup, paper, insect box</td>
<td>Transparent plastic cup, paper, insect box</td>
</tr>
<tr>
<td></td>
<td>paper</td>
<td></td>
<td>Paper</td>
</tr>
<tr>
<td></td>
<td>Insect box</td>
<td></td>
<td>insect box</td>
</tr>
</tbody>
</table>
| Step | 1. Use two clear plastic cups to hold mosquitoes  
2. Put the caught mosquitoes in the insect box | 1. Cover mosquitoes with clear plastic cups  
2. When mosquitoes flying over, cover with a plastic cup.  
3. Put in the insect box. |
|------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Advantage | 1. Learn more about the creatures in the ditch | 1. Single background color  
2. Sufficient lighting | 1. Good for health |
| Shortcoming | 1. Stereo space  
2. Background color is rich  
3. Poor light | 1. Can’t catch if mosquitoes fly too high | 1. Spend more time |
| Results | Caught 8 mosquitoes | Caught 17 mosquitoes | Caught 3 mosquitoes |
**Location**: Ditch

**How mosquitoes appear**

- Gutter cover

![Top view diagram]

- Sludge at the bottom of the ditch

Flying 4 centimeters off the ground along the ditch.

**How we caught**

1. Slowly trap with two cups
2. Put paper between two cups
3. Insect box

**Done!**
3. Place artificial water.

Idea:
Because it hasn't rained for many days, artificial stagnant water is created to catch mosquitoes.

Location:
Water ditches (three ditches were selected)

Material:
a container
Capture method:
1. Put a water container in the ditch
2. waiting for mosquitoes to lay eggs
3. After a day, observe the container for larvae
Number of leeches caught this way: 0

advantage:
No need to spend time and effort catching mosquitoes

shortcoming:
Wait for it lay eggs waste time
Risk of promoting mosquito breeding
experiment
Mosquito's preference for hot and cold

Material:

150ml hot water at 96°C
150ml cold water at 7°C
paper cup
carton, plastic wrap
rough tape
white paper
Graduated cylinder
Thermometer
step:

1. Put white paper for observation.
2. Add 96°C hot water and 7°C cold water.
3. Seal with plastic wrap.
4. Put mosquitoes into carton.
(2) Experiment of carbon dioxide’s attraction to mosquito

Creature:
8 mosquitoes

Chemical material:
calcium carbonate(grams)、32% hydrochloric acid(50milliliters)

Material:
paper、carton、fine tape、thick tape、transparent plastic box、plastic wrap、transparent plastic cup、burette、burette holder、ring stand、three prong clamp、rubber stopper、rubber hose、spatula、electronic scale、scale paper、Styrofoam board、filtering flask

Principle:
\[ \text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2 \uparrow \]
step:

air box → carton → H₂O box

50mL 32% hydrochloric acid

150g calcium carbonate
results:

• Six into the box with carbon dioxide, two in the carton.

• The mosquitoes that flew into the CO2 box all died, but the ones that stayed in the main box didn't.

• Mosquitoes fly around when exposed to carbon dioxide at first, and die quickly after a while.

• Carbon dioxide is indeed attractive to mosquitoes, but too much carbon dioxide can kill mosquitoes.
(3) Using yeast to produce carbon dioxide to capture mosquitoes

**Material:**
Two identical plastic bottles, yeast, sugar, heating panel, water, spoon, Dropper, Graduated cylinder, Beaker, utility knife, Thermometer, weighing paper, Petri dish, tape, electronic balance

**Principle:**
Using the EMP (Embden-Meyerhof Parnas) approach

\[
C_6H_{12}O_6 + \text{yeast} \rightarrow 2 \text{C}_2\text{H}_5\text{OH} + 2 \text{CO}_2
\]
Step:
1. Add 28ml of water and 2g of sugar to two beakers.
2. Heat to 40°C.
3. Cut two plastic bottles 5cm away from the bottle mouth.
4. Pour the heated sugar water into two plastic bottles.
5. Add 0.5g yeast to one of the cups.
6. Put the cut bottle mouth upside down on the bottle body.
7. Put in a dark place beside the ditch for one night.
Results:
No mosquitoes were caught, but other insects were caught.

<table>
<thead>
<tr>
<th></th>
<th>2022/2/25</th>
<th>2022/2/26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar and water</td>
<td>Drosophila: 4</td>
<td>Big ant: 39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Small ant: 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drosophila: 17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Housefly: 1</td>
</tr>
<tr>
<td>Sugar water</td>
<td>Drosophila: 56</td>
<td>Big ant: 2</td>
</tr>
<tr>
<td>with yeast</td>
<td></td>
<td>Drosophila: 48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Small Drosophila: 30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Housefly: 2</td>
</tr>
</tbody>
</table>
Discussion
(1) Mosquitoes' preference for hot and cold

Assumptions:
Mosquitoes will move closer to the warmer side.

Experimental results:
Mosquitoes move closer to cooler temperatures.

Speculated reason:
A shady place means that mosquitoes can lay their eggs there, so there are more mosquitoes in a shady place.
(2) Carbon dioxide’s attraction to mosquito

Assumptions:
Mosquitoes will fly to places with high carbon dioxide levels.

Experimental results:
Mosquitoes fly to places with higher carbon dioxide concentrations, but die after a while.

Speculated reason:
A place with more carbon dioxide is usually a place where creature is infested. Mosquitoes need suck blood to reproduce, and they may link carbon dioxide to a food source.
(3) Using yeast to produce carbon dioxide to capture mosquitoes

Assumptions:
Mosquitoes fly into plastic bottles where carbon dioxide is produced by sugar water with yeast.

Experimental results:
No mosquitoes flew into two plastic bottles, but most Drosophila, Housefly flew into plastic bottles with yeast.

Speculated reason:
Carbon dioxide may be attractive to Drosophila. While sugar water with yeast can produce odors, Drosophila may be attracted to the smell, not the carbon dioxide.
Conclusion

• People who have just finished exercising attract mosquitoes.

• Compared to temperature, carbon dioxide is the main factor that attracts mosquitoes.

• Mosquitoes like shady places, because shady places usually have water.

• The easiest and most time-saving way to catch mosquitoes is captured with transparent plastic cup in toilet.
Bibliography/Citations

• Embden–Meyerhof–Parnas: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5440799/

• Embden-Meyerhof Parnas: https://zh.wikipedia.org/wiki/%E9%85%92%E7%B2%BE%E7%99%BC%E9%85%B5%E6%87%89

• Calcium Carbonate and Hydrochloric Acid Reaction: https://www.chemistryscl.com/reactions/CaCO3+HCl/index.php
## Division of labor

<table>
<thead>
<tr>
<th>Team member</th>
<th>Assign work</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUO, XIN YI</td>
<td>catch mosquitoes</td>
</tr>
<tr>
<td></td>
<td>Experiment 1 Mosquito's preference for hot and cold</td>
</tr>
<tr>
<td></td>
<td>Experiment 2 Carbon dioxide’s attraction to mosquito</td>
</tr>
<tr>
<td></td>
<td>● Research question and hypothesis</td>
</tr>
<tr>
<td></td>
<td>● Research methods and materials</td>
</tr>
<tr>
<td></td>
<td>● Results</td>
</tr>
<tr>
<td></td>
<td>● Discussion</td>
</tr>
<tr>
<td></td>
<td>● Conclusion</td>
</tr>
<tr>
<td>HUANG, YU CHIN</td>
<td>catch mosquitoes</td>
</tr>
<tr>
<td></td>
<td>Experiment 1 Mosquito's preference for hot and cold</td>
</tr>
<tr>
<td></td>
<td>Experiment 2 Carbon dioxide’s attraction to mosquito</td>
</tr>
<tr>
<td></td>
<td>Experiment 3 Using yeast to produce carbon dioxide to capture mosquitoes</td>
</tr>
<tr>
<td></td>
<td>● Research question and hypothesis</td>
</tr>
<tr>
<td></td>
<td>● Research methods and materials</td>
</tr>
<tr>
<td></td>
<td>● Results</td>
</tr>
<tr>
<td></td>
<td>● Discussion</td>
</tr>
<tr>
<td></td>
<td>● Conclusion</td>
</tr>
<tr>
<td>LIU, YU HSUAN</td>
<td>catch mosquitoes</td>
</tr>
<tr>
<td></td>
<td>● Abstract</td>
</tr>
</tbody>
</table>
Thanks For Listening.