

Mosquito control, killing off the females

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Research Article

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Abstract

In addition to causing discomfort, female mosquitoes introduce disease-carrying viruses and bacteria into the bloodstream of their victims. There are numerous publications describing the uses of sugary mosquito baits with promising results. However, without temperature control measures, these methods are mainly useful for only nectar feeding insects, including male mosquitoes, because the warmth of the blood is a condition for the females to locate their meals. The efforts required to keep the baits fresh against the natural spoiling process make them less attractive or impractical to implement. These experiments address these issues by using warm baits of water, sugar, boric acid and antibiotics. On the surface, the area became a sought-out island where mosquito activities flourished; nevertheless, the mosquitoes were exclusively males (almost). Control vs. experiment protocol established no other logical explanation for this phenomenon other than that the females were attracted and killed by the bait. As expected, there was no mosquito egg laying in these areas.

Introduction

In the field, the above mentioned scheme worked, and the neighbors were happy. Yet, observations and feedback are considered subjective opinions, and the academic world demands objective and reproducible results.

The baits were primarily selected based on common sense, as mosquitoes feed on nectars made up of sugary solutions. Boric acid is a known insect toxin, warmth is one condition by which females locate their meals, and antibiotics are germ-killing agents used to prevent things from being spoiled to keep them active as long as the loss of active ingredients is compensated.

Thus, through trial and error, we decided on a warm-water solution of % sugar, 5% boric acid, and traces of antibiotics. As a result, both female and male mosquitoes were drawn to the area. Only the females consumed the solution, and their guts contained sharp crystals¹. Although the caught mosquitoes were almost exclusively males, the numbers significantly increased. There were two further observations that validated our ideas: (a) When placed in the chamber with the bait, the samples died in a few hours with few exceptions, and most of the carcasses were in the immediate vicinity² of the bait, as if the fatal incidents occurred suddenly in midair. This explains the phenomenon that only a few females were caught. Furthermore, (b) crystals³ began to form when the solution reacted with gelatin, a form of animal fat.

Previous experiments depended on laboratory environments, with live samples available in valid numbers. Out of necessity, this endeavor started as an attempt to find a method to attract and collect wild mosquitoes for experimental purposes, as traps on the market or built following publicly available instructions failed to produce sufficient quantities and/or healthy samples.

During the course of our search for a method to prove the efficacy of mosquito-repelling light and the need for samples in small quantities for quick tests, we relied on wild samples. Using several black

trashcans placed in the corner of a backyard shed within ½ hour after sunrise*, we were able to gather approximately 10 mosquitoes on warm days. By keeping one unit dry, calm, vibration-free, noise-free, and cooler than the surrounding area, we were not only able to more than double the number caught but also to clear them from the places where they normally came for the days.

The recent deployment of the bait yielded dramatic increments. Occasionally, experiments required the use of hands and arms of the operators on starved samples to determine that the mosquitoes' appetites had diminished or were eliminated. Further investigations were performed to remove and/or to simplify the process and the equipment. In addition, the paper describes the final assessment.

The catching method gave us a means to measure the effect of the baits with experimental and control protocols in the field. Although the effective radius was observed to be hundreds of meters, the distance was not within the scope of the presentation, and the experiment focused on the difference between the presence and absence of the baiting apparatus.

Equipment And Method

Equipment:

The experiments required two major components: the baiting apparatus and the catching device.

Figure 1 shows that the baiting apparatus⁴ is a wax warmer set at 40 °C (104 °F) with a large wick. It contains baiting solution (water + 5% sugar + 5% boric acid) and over-the-counter triple antibiotic ointment at a pea-size-per-liter ratio. The same ratio of plain water and antibiotic was also applied for refilling the apparatus after evaporation of water during the sessions

Figure 2 illustrates the components⁵ of the catching device, including a 24' x 24' x 32' insulated chamber, a 31-gallon metal trashcan with its inside painted black, a fan to circulate the air, and a small refrigerator. The device also needs a dual-probe thermostat to regulate the temperature of the inner side of the can and its surroundings, making it 0.5 °C (0.9° F) cooler. It also needs some debris of a dark color, such as wooden sticks, to provide places for mosquitoes to land and to be collected.

Both devices were placed *on the ground* approximately 2 m apart in the calm corners of the shed-like facility, which was known to have a slight-to-moderate mosquito problem**.

Method:

There were 5 experimental sessions, and 5 more sessions were performed without a baiting control, each lasting a full day to end with the collection of the samples at ½ hour after sunrise using a low-power vacuum suction. The mosquitoes were then killed, and males and females were then separated and counted.

In both cases, the sessions occurred during summer days, and if anyone encountered a downpour or it was too cool, the data from that day and the next four were not considered valid for the record.

Result

5 Control Sessions. From 07/30/2021 → 08/03/2021⁶

Total	Male	Female
133	68	65
100%	51%	49%

5 Experiment Sessions: From 07/23/2021 → 08/03/2021⁷

Total	Male	Female
291	284	7
100%	98%	2%

Discussion

The following illustrations are the side by side visualizations of the above numbers.

- (Figure 3) In control settings, the 49% vs. 51% female vs. male distributions validate the common wisdom that the sexes occur in somewhat equal ratios in nature. Without counting the attractive characteristics of the bait, the female mosquito population decreased from 49% to 2%. Thus, it was the baits that caused this unnatural phenomenon
- In addition to the increase in the total populations between the control and experimental sessions, the male populations increased from 68 to 284 or 418%. Therefore, it is logical to state that the bait attracted mosquitoes.
- In short, the baiting apparatus attracted mosquitoes and killed the females.

Observations:

- Although they are not shown in the pictures, all the female mosquitoes in the experiment showed signs of recently being fed (i.e., their bellies were full). They died within 2 hours after being caught.
- Neighbors 300 feet away reported not being bitten by mosquitoes.
- Within the 200-foot boundary, there was not only no mosquito-bite activity but also little or no sign of mosquito egg-laying activities in the shaded, standing water bodies previously used for collecting larvae.

Conclusion

This study attempted to address the issue of mosquito bites and was successful. The baiting method drew in mosquitoes from a fairly large vicinity, and the population of female mosquitoes was drastically reduced and was nearly eliminated without harming the males. There was no sign of harm to other insects. At minimum, this approach provides comfort in that by reducing the chances of being bitten, the risk of becoming infected with mosquito-vectored diseases is reduced. With the availability of equipment at the local level, inexpensive community applications are within reach. We may perhaps never want to eradicate mosquitoes, but this method gives us a means to control them when they pose imminent threats.

Declarations

I, Phi Tran declare no competing interests

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Footnotes

* Soon after sunrise, the temperature and the light induced by the sun causes them to look for a more suitable hideout .

** A place is considered to have a slight mosquito problem if one puts a large, black trashcan in a dark corner and is able to catch fewer than 5 mosquitoes a day. More than 5 and less than 10 indicates a moderate mosquito problem. The selection aims to represent typical urban area.

¹ ["Female Gut W Blood & Crystals. JPG"](#) and ["Female Gut No Crystal.JPG"](#) [Female Gut With Crystals.JPG](#)

² ["Death Samples.JPG"](#)

³ ["Crystal Forming.JPG"](#)

⁴ ["Waxwarmer+Wick+AutoFill.JPG"](#)

⁵ ["Catching Device..JPG"](#)

⁶ Details of control sessions with date and pictures.

Date :	Total	Males	Females
07-30-2021	36	18	18
07-31-2021	14	8	6
08-01-2021	27	14	13
08-02-2021.	25	13	12
08-03-2021	31	15	15
Total	133	68	65
	100%	51%	49%

⁷ Details of experiment sessions:

Date:	Total	Males	Females
07-23-2021	68	65	3
07-24-2021	63	61	2
07-25-2021	46	46	0
07-26-2021	52	51	1
07-27-2021	60	59	1
Total	289	282	7
	100%	98%	2%

Figures



Figure 1

Figure 1

Figure 1 shows that the baiting apparatus⁴ is a wax warmer set at 40 °C (104 °F) with a large wick. It contains baiting solution (water + 5% sugar + 5% boric acid) and over-the-counter triple antibiotic ointment at a pea-size-per-liter ratio. The same ratio of plain water and antibiotic was also applied for refilling the apparatus after evaporation of water during the sessions

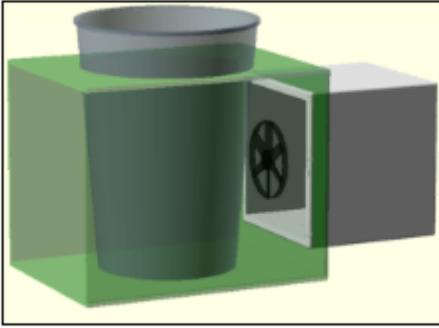


Figure 2

Figure 2

Figure 2 illustrates the components of the caching device, including a 24' x 24' x 32' insulated chamber, a 31-gallon metal trash can with its inside painted black, a fan to circulate the air, and a small refrigerator. The device also needs a dual-probe thermostat to regulate the temperature of the inner side of the can and its surroundings, making it 0.5 °C (0.9° F) cooler. It also needs some debris of a dark color, such as wooden sticks, to provide places for mosquitoes to land and to be collected.

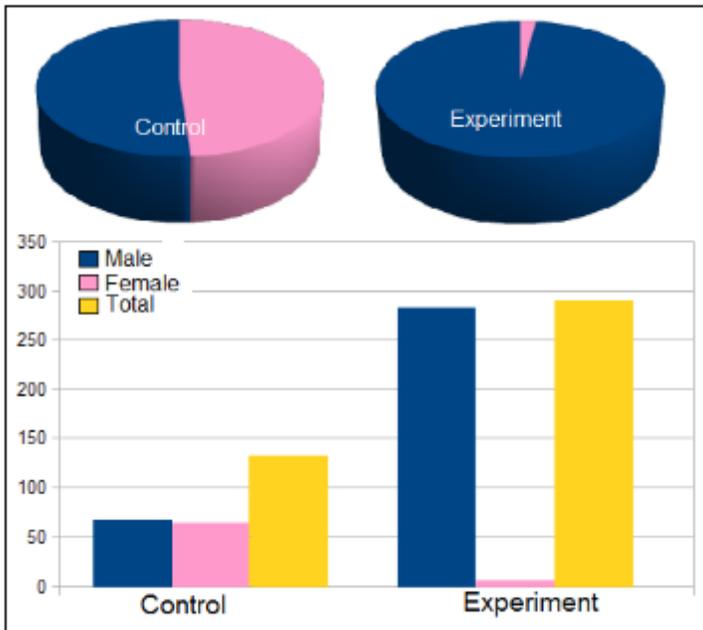


Figure 3

Figure 3

In control settings, the 49% vs. 51% female vs. male distributions validate the common wisdom that the sexes occur in somewhat equal ratios in nature. Without counting the attractive characteristics of the bait, the female mosquito population decreased from 49% to 2%. Thus, it was the baits that caused this unnatural phenomenon

Supplementary Files

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- [WaxwarmerWickAutoFill.zip](#)