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Temporal Analysis of Behavior of Male and Female Lucilia sericata Blow Flies Using Videography

Temporal analysis of male and female *Lucilia sericata* blow flies using videography

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Introduction

Lucilia sericata, the green bottle fly, belong to the family Calliphoridae and is one of the most common in the genus *Lucilia*. *L. sericata* are located around the world, however they generally populate the Northern Hemisphere. *Lucilia sericata* are among the many different types of insects that are used in the field of forensic entomology. Forensic entomology is the use of the insects, and their arthropod relatives, that inhabit decomposing remains to aid in criminal investigations (Davies & Harvey). Forensic entomology is broken down into three main concentrations: medicolegal, urban, and stored product pests. (Byrd & Castner). For this study, the area of interest is the medicolegal concentration. Medicolegal forensic entomology is concerned with the criminal aspect of the legal system and is associated with the feeding insects, such as *L. sericata*, that typically use decomposing human remains as a protein source (Byrd & Castner). *L. sericata* is attracted to a corpse in open air within minutes after death and are usually among the first insects to colonize the corpse (Byrd & Castner). As a result of extensive research the larva staging of *L. sericata* has become one of the best resources for criminal investigators to determine the time of death.

Understanding whether the *L. sericata* are able to locate and oviposit during nocturnal conditions is of forensic importance as well. *L. sericata* has been shown to oviposit in cool nocturnal conditions, however this is quite uncharacteristic to the normal daytime ovipositing behavior (Catts and Goff). One study has shown that the probability of *L. sericata* navigating during the nighttime to a corpse is low (Wooldridge).

The objective of this experiment is to study the behavior of male and female *L. sericata* with respect to organic material resource utilization. Protein (organic material) is a required dietary component for female flies for completion of sexual development, vitellogenesis, and the production of sex pheromones while a dietary protein requirement for males has not been elucidated .

Materials and Methods

Flies were kept inside an enclosure that was kept at 28 degrees Celsius and at 40% humidity. The enclosure was kept on a light dark cycle that was 6:00 AM to 6:00 PM light and from 6:00 PM to 6:00AM darkness. The camera that was used was a Sony HandyCam. The autolight setting was ON all day and all night to keep video constant through light and dark of the enclosure. The video was stored onto a MyPassport 2 TB hard drive. The video was viewed and edited on a Mac Book Pro laptop. The flies were kept in two connected BugDorms, they were connected with a netted tube. The first BugDorm housed the water treatments and honey water treatments. A water treatment is contraption that allows the flies to have water slow released over the period of a couple days. This was replaced every other day. A honey water treatment is a paper towel that is saturated with half water, half honey solution that is placed on a plastic plate. The second BugDrom housed the liver and the camera that focused on the liver. The liver was placed on a paper towel that allows the flies to feed and lay eggs on. The camera was placed on the top of the BugDorm looking down as to see all sides on the liver. The Sony HandyCam can hold 8 hours of footage. That footage was transferred to the hard drive once full and then deleted off of the camera. The camera started filming at 0900 and was set up at 1800 to film at night, just during dark cycle.

FIGURE 6. The setup of the two connected bugdorms.

FIGURE 1. Image of one (circled in yellow) *L. sericata* at 6:01 PM around the liver source.

FIGURE 2. Image of four *L. sericata* at 2:06 PM around the liver source.

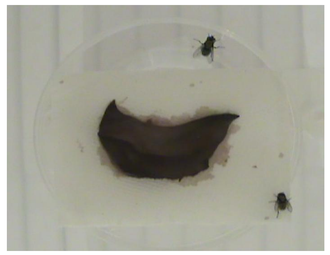

FIGURE 3. Image of two *L. sericata* at 4:21 PM around the liver source.

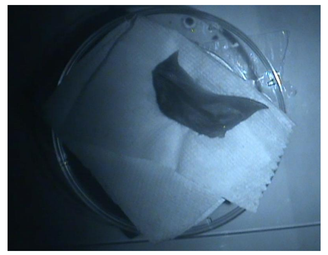

FIGURE 4. Image of no *L. sericata* at 1:30 AM around the liver source.

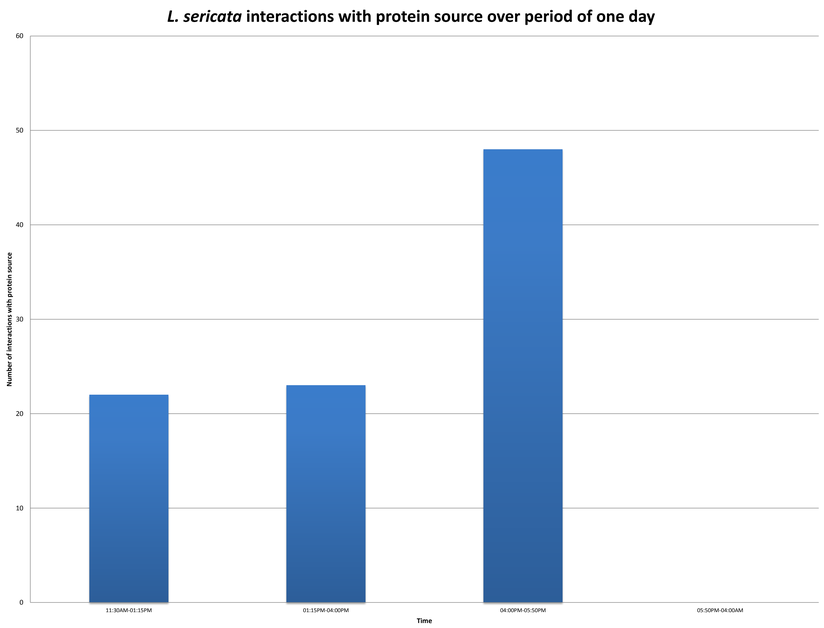

FIGURE 5- Chart of Number of fly interactions with protein source over one day. The times of the day are divided into 4 sections.

Results

The activity level in the *Lucilia sericata* dramatically decreases during the dark cycle based on the preliminary data collected. Figure 4 was taken at 1:30 AM and shows no activity, whereas Figure 2 was from 2:06 PM and shows normal light cycle activity. In Figure 1 only one *L. sericata* can be observed on the liver source at 6:01 PM. However in Figure 2 and Figure 3 multiple flies can be observed at the liver source, Figure 2 was from 2:06 PM, where there are four flies observed on the liver, and Figure 3 is from 4:21 PM, where there are two flies on the liver source. No fly activity was observed throughout the entire dark cycle on all trials performed. A pattern is observed about the activity level of *L. sericata* and is presented in Figure 5. Figure 5 depicts the number of fly interactions over a given day. This chart is divided into four sections. This chart shows a dramatic decrease in protein encounters once the dark cycle has begun (6:00PM).

Discussion and Conclusions

Our preliminary data set is not sufficient to either support or disprove the hypothesis that male *Lucilia sericata* behave differently around a protein source than female *Lucilia sericata*. The data do demonstrate that *Lucilia sericata* have overall decreased activity at night. The flies were observed through cameras that filmed the protein source throughout the night. Decreased dark cycle activity was expected based on research that shows an increase in ovipositing activity during the daytime hours (Catts and Goff, 1992). The equipment used for this project was adequate for the task due to the quality of video evidence that was gathered thus far. It is important for the camera to be HD so that we can observe the difference in activity of the flies at the protein source. The behavioral analysis will incorporate not only the number of interactions with the protein source, but also the extent of the interaction. The HD capability will also be used to determine the sex of the flies when a mixed population is being used. The experiment design appears adequate but could change once more data has been collected. The design of the Bugdorms is essential to collecting data specific to fly encounters with protein (Figure 6). The honey water treatments and water treatments were isolated from the protein source in order to determine specific interactions with the protein. The interactions seen on camera will be from an intentional trip to the protein as opposed to random landing.

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