The Feeding Behavior of *Acheta domesticus* Infected with *Paragordius varius*

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Abstract: There has not been a lot of research on the phylum nematomorpha, hairworms. There is a large gap in the knowledge of hairworms in their host-parasite relationship, especially on their dietary habits. Our study observed the food consumption of house crickets (*Acheta domesticus*) by hairworms (*Paragordius varius*). We recorded the mass of the amount of food consumed by the crickets every five days. Our study did not identify a difference between crickets exposed to hairworms and those not exposed but this may be due to unexpected deaths of the crickets and a small sample size of infected crickets further research needs to be conducted to determine if the food consumption of crickets infected with hairworms differs from uninfected crickets.

Keywords: *Paragordius varius, Acheta domesticus,* Feeding-Behavior, Hairworm

Introduction

Phylum nematomorpha, commonly known as hairworms, are parasites of crickets and other arthropods (May 1919). Hairworms can alter the behavior of their hosts to be beneficial for itself by regulating the hosts' central nervous system (Biron et al. 2006). The hairworms manipulate the crickets to start wandering in search of water. Scientists believe that the hairworm waits until the cricket is near the water for their chance to exit the cricket (Hanelt et al. 2005). While most insects parasitized by the hairworm commit 'suicide', it is not a death sentence. When the insects approach the water, the infected crickets jump into the water (Hanelt et al. 2005). Upon entering the water, the hairworm is released (Hanelt et al. 2005). *Paragordius varius*, a species of hairworm, are fully developed in about 30 days. This species can reach up to a length of 1 mm ten days after infection. After 25 days, the hairworm is fully developed. No studies have addressed the feeding behaviors of crickets infected with nematomorpha. Our study was designed to determine if there was a difference in the feeding habits of crickets (*A. domesticus*) infected with hairworms compared to uninfected control crickets. We predicted that the crickets will decrease their food consumption infected crickets will decline as the hairworm grows.

Methods

To infect crickets with a hairworm we used a laboratory-cultured stock of *Paragordius varius* stored in -80°C freezer at OSU. We inoculated *Physa gyrina* with *P. varius*.. This was done by pipetting approximately 200 hairworm larvae in 48-2mL well plates with 1 mL of water. Individual snails were placed in each well and allowed to feed on the hairworm larvae mixture for 48 hours. Then we checked them for cysts after two weeks. The infected snails were fed to *A. domesticus*. *P. gyrina* is not a part of the natural diet of *A. domesticus*, so to get the crickets to consume the snail tissue we had to starve them for 48 hours before feeding them the tissue. The specimens that were infected were to be fed to *A. domesticus*. The crickets that were fed the snail tissue were separated and became the experimental group.

The crickets were housed individually in 236 mL polystyrene with a replenishing food dish, a water

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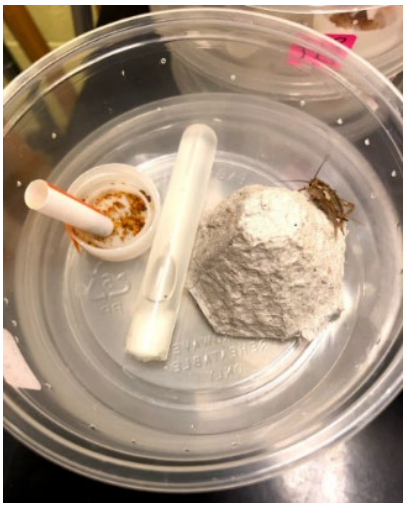

Figure 1: This was the setup of all of our crickets' housing. Pictured left to right is their food dish, water tube, and egg carton hideout. Photo taken by Bailey Lagarde.

tube, and an egg carton (Figure 1). The replenishing food dishes were made from a water bottle cap with a fragment of a straw glued to one of the inside rims that was filled three-quarters of the way with ground up Purina Puppy Chow® dog food. We used that design for their food dishes because we found that they won't kick their food around their house like they do when given just a small dish of food The crickets were separated into four groups- control female, control male, exposed female, and exposed male crickets. The experimental group- which were exposed to infected snail tissue consisted of 42 female crickets and 47 male crickets. The control group consisted of 55 females and 55 males. After separating the groups, the crickets were then assigned numbers to monitor each crickets' consumption habits. The crickets were kept in a laboratory at a constant 75 degrees Fahrenheit during the duration of the project.

The crickets' food dishes were removed every 5 days and replaced with a fresh dish of food. To replace the food, we removed a cricket's food dish, placed a sticker with the cricket's number on it, and then placed that food dish on a tray to be weighed. Before placing the new food dishes in the cricket's housing, we would record the weight of the dish with the food on a sticker and placed the sticker on the outside of the water bottle cap. To weigh the food dishes, we removed the food to be weighed for one cricket, put its sticker on the food dish, put that food dish on the tray, and then place a new food dish in the cricket's house. When ready to weigh the food dishes, we recorded the cricket's number and the initial mass of the food dish, removed the stickers, and recorded the final mass of the food dish.

Every day the crickets were individually checked for any deaths and for molts. We recorded every molt and death- the crickets who died were moved and the molts were removed from their housing. If we did not remove the molts from the housing the crickets would have eaten them and interfered with our data collection.

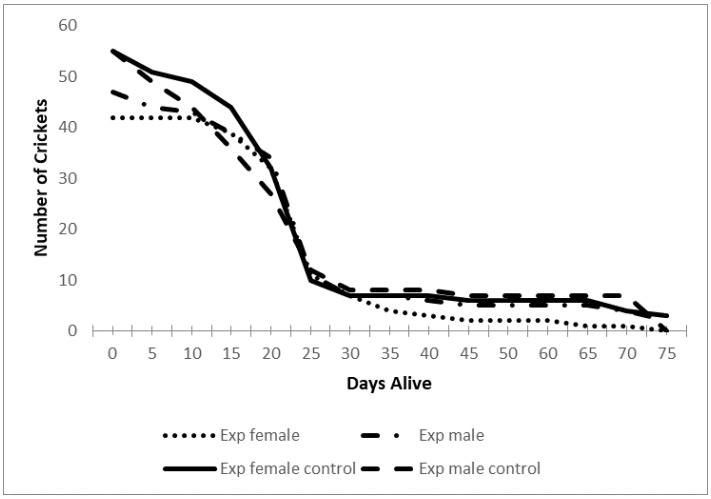

Figure 2: The survivorship of experimental and control groups.

Results

Of the 55 control males 0 survived, 3 of the control females, 0 exposed females, and 2 exposed males survived the entirety of the 75 day experiment. During the second and third week of the experiment, there was a large number of unexpected deaths (Figure 2). By day 20 70% of the crickets had died (Figure 2). We only had one cricket that we were able to confirm was infected- a female. No male crickets became infected. When comparing the consumption of the crickets throughout the experiment, all the crickets consumed food in the same pattern (Figure 3). It was also observed that on average, the exposed and control

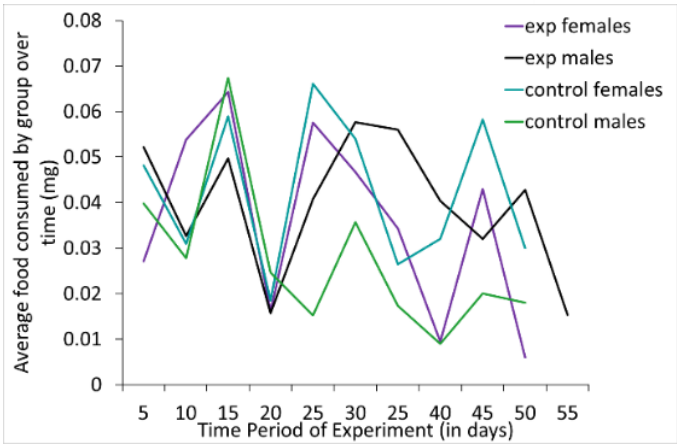

Figure 3: The average amount of food consumed by all groups throughout the course of the experiment. The groups have similar patterns suggesting they ate similarly and were not affected by infection

females consumed roughly the same amount of food and the exposed and control males also consumed the same amount of food (Figure 4).

Discussion

Based on our results we cannot conclusively say that the hairworm affected the feeding habits of the cricket. This is because we only had one infected cricket. In our study, we encountered a mass unexpected death of our crickets from day 12 to day 25 (Figure 2). This may have been due to a virus they contracted, or the pesticides sprayed around campus. Because the cricket groups had similar eating patterns, this suggests the exposed groups, males and females, were not infected (Figure 3). After approximately 30 days, data was based on 4 males with one infected female. This may have caused the average food consumption to decrease for experimental males because as worms get larger, crickets eat less (Figure 3). Another reason why the food consumption declined is when the crickets were 50 days old they were transforming into adults. It has been demonstrated that crickets eat less when they molt to adults (Nowosielski 1965). Days 1 through 10 the exposed females had an increase in their food consumption whereas there was a decline in food consumption in the control female group (Figure 3). Further research on the feeding habits of female crickets could be to determine if initially increasing consumption of food helps them fight off infection. When continuing research on the feeding habits of crickets infected with hairworms to increase the success rate we would recommend keeping the crickets in an incubator at 80 degrees Fahrenheit to encourage faster growth of the organisms and to isolate the crickets from biological and environmental factors that could hinder development or lead to the organisms' death.

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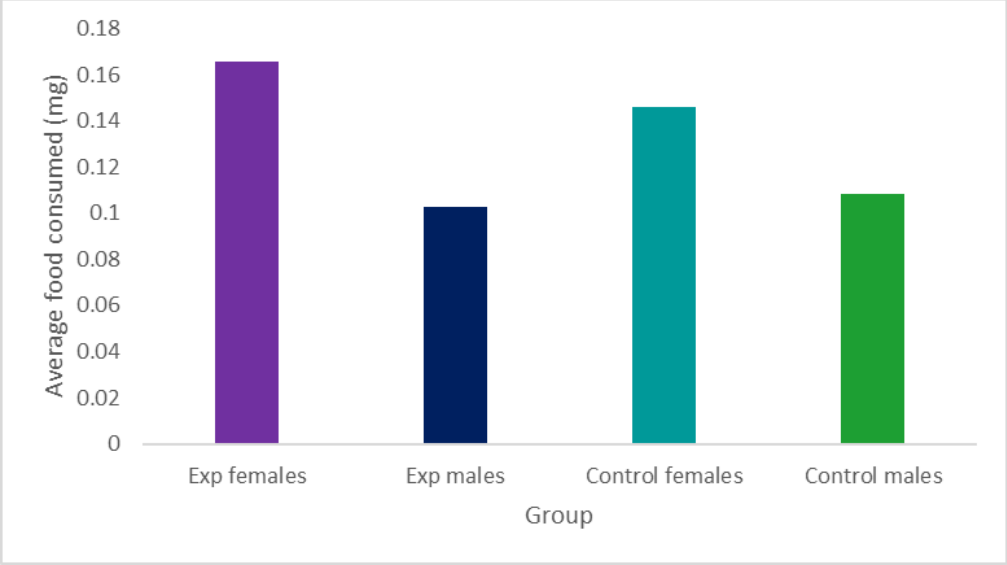

Figure 4: The overall average amount of food in mg consumed by each group.