A Study on The Effects of Different Chemical based and Natural Pesticides on *Gryllodes sigillatus*

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Anything you change

Abstract: Crickets, although not known to be direct vectors for transmitting diseases, are considered to be a nuisance species and can affect an individual's health indirectly. The cricket *Gryllodes sigillatus* is in the order Orthoptera and family Gryllidae. Much like the cockroach and the common house fly, *Gryllodes sigillatus* can be found in homes and as a result, can cause problems such as fabric damage, fabric staining, food contamination, and create incessant chirping. *Gryllodes sigillatus* was chosen as the experimental subject species because of its common distribution around the Southern part of the US border. The experimental study section provides information on the efficiency and effects of different chemically and natural based pesticides can have on the species *Gryllodes sigillatus*. Specimens were observed over a set time interval in three separate trials. A discussion of the benefits of using natural pesticides in place of chemically based pesticides was made based on data collected from the trials.

Keywords: nuisance, crickets, pesticides, natural, Gryllidae

The family Gryllidae has certain morphological modifications that can help distinguish and identify it from other families under the order of Orthoptera. For example, *Gryllodes sigillatus* is about 13-18mm long, and has a flattened shape. Their coloring ranges from dark brown, yellowish-brown, and black and the males will tend to have shorter wings when compared to the female. The main difference between the *Gryllodes sigillatus* and the common house cricket, is the much more narrow space between the two thread-like antennae (Walker). However, both species have antennae that are longer than their bodies, and since we were using adult crickets, the males are known to have two appendages extending from their abdomen, whereas the females had three. The presence of two abdominal cerci, three tarsal segments and sensory setae that are located basally on the inside of the cerci are all common characteristics between the crickets and are used for identification (Resh, 2009). Fig. 2, 3 and 4. can be used to see the lateral, dorsal and frontal view of the species.

All members of the Gryllidae family will start as eggs, develop into nymphs and end us as adults. They can live up to six weeks, making their entire life last about two-three months, but this can also depend on their environment (Walker). This species of cricket can lay up to 40-170 eggs and can breed indoors, leaving their eggs in small cracks and crevices that may not be noticable to home residents (Leser). The *Gryllodes sigillatus* will begin its cycle as an

egg for about 14 days, and then develop into nymphs which are small identical versions of the adult *Gryllodes sigillatus*. The major difference at the nymph stage, is the lack of wings and ovipositors in females. In order for *Gryllodes sigillatus* to go into the final stage of adulthood, the nymph must first molt about 8-10 times and develop a new exoskeleton. Once a cricket reaches its full maturity, its wings are fully developed and will spend the rest of its life gathering food and searching for a mate. Males often have wings that cover only half of their body, whereas the female are practically wingless. They are commonly found in the states near the Southern border such as Texas, Florida, southern California, and Arizona as illustrated in Fig. 1.and are active at night looking for shelter inside of houses foraging through the house as "pests" (Walker). This species of cricket is known to cause damage indoors and outdoors. Damage to gardens, crops, fabric, carpeting, and contamination of food can affect an individual's health, source of economic stability, and lead to major financial issues for prevention and controlling purposes. Chemically based pesticides are often used for getting rid of crickets and other insects, however the use of chemicals can also have a negative effect on an individual's health. Natural pesticides can be used as a safer alternative option, however, not many people believe that they are as efficient as chemically based pesticides since they are not commonly used. Most natural pesticides can be made at home with little amounts of ingredients that can be found in everyday supermarkets. This study aimed to test the effects and efficiency of name brand chemical based pesticides in comparison to a naturally based pesticide on the common *Gryllodes sigillatus* species in order to provide a safer alternative for cricket control.

Materials & Methods

Material Information

In this experiment, 200 adult *Gryllodes sigillatus* were used as the experimental subjects. The supply of crickets used in this experiment were all purchased from the same company, (Carolina Biological Supply, Burlington, NC) by Texas A&M University's Entomology Department in order to ensure that all of the crickets came from a common source. The experimental factors were five different common pesticides that were tested during this experimental process. The pesticides chosen were common brands that are popularly used and known to be both effective and accessible for cricket control. The objective was to test the efficiency of each brand and the difference in performance that a natural pesticide would have when compared to chemical based pesticides. Out of the five pesticides, four of them were chemical based and store bought from Home Depot, except for the Bio Advanced Science-based Solutions Complete Insect Killer, that was purchased from Amazon due to it being out of stock at Home Depot. The 5th pesticide used was a natural pesticide consisting of 3 drops of eugenol (clove oil), 3 ½ teaspoons of non-antibacterial dish soap (Dawn brand), and 20 oz of water from the Texas A&M University Heep building water supply. The ingredients for the natural pesticide called for ten drops of eugenol, 8 teaspoons of a non-antibacterial, non-fragrant dish soap and 2 quarts of water in a spray bottle (Williams), however, the spray bottle was large enough to hold 2 quarts (64 oz), so the ratio of the ingredients was adjusted for the experiment. The four store bought pesticides that were used were: Ortho Home Defense Killer (24oz), Triazicide® Insect Killer (32oz), Bug Stop 1 gal. RTU Home Insect Control (32oz), and Bio Advanced Science-

based Solutions Complete Insect Killer (32oz). Plastic containers were used to separate the crickets in groups of ten instead of glass containers due to their better heat insulation quality. Each container was 3.8 L in volume in order to reduce the risk of death due to overcrowding and provided enough space for the crickets to move around (Top Hat Cricket Farm). The containers were each marked with masking tape and labeled with the type of pesticide used for each group for a total of six containers. All of the containers were bought from the same store (H-E-B) and foil paper was used to cover the containers instead of the lid that came with each, so that it was easier for oxygen to reach the crickets.

Experimental Process

The crickets were separated into groups of ten and placed into their separate containers each with a corresponding pesticide and one being a control group. At 4:00pm, the pesticide assigned to each container was equally sprayed into each container three times, ensuring that the same areas were covered for each container. The initial thought was to collect the data observed at 1 hour, 3 hour, 6 hours, 24 hours, and 48 hours, but the pesticides had a rapid effect on the crickets and the data tables were changed to match the rate of effect. All of the containers were monitored with a set timer for each container in order to calculate the responding variable, which was the percentage of crickets that survived each pesticide after 5mins, 10mins, 15mins, 20mins, 25mins, 30mins and 1 hour. This process was repeated for three separate trials and the data for each trial was recorded in Tables 1-3. The control group was not sprayed with any pesticides, but was cared for in the same way as the experimental subjects were. At the end of the experiment, the most efficient pesticide for cricket control was determined based on manipulation of the dependent variable (type of pesticide used on each group of crickets) and the responding variable (number of surviving crickets for each pesticide).

Ideal Experimental Setting/Specimen Preservation

During the experimental process, all of the crickets were fed and cared for in order to keep them healthy enough to withstand the trails. A shallow dish was placed in the container where the specimens were kept in as their source of water, and was replaced several times a week (Top Hat Cricket Farm). As for feeding, we placed the same amount of food such as small chunks of potato, lettuce, apples, oranges, and pumpkin seeds for them to feed on (Top Hat Cricket Farm)**.** Although the experiment was conducted outside, the specimens were kept in the Heep building at Texas A&M University in a closed area with a room temperature of about 70 degrees Fahrenheit, since this is the most ideal temperature for crickets (Top Hat Cricket Farm).

Experimental Data Tables

1st Trial							
Pesticide Used	**5 Minutes**	**10 Minutes**	**15 Minutes**	**20 Minutes**	**25 Minutes**	**30 Minutes**	**1 Hour**
Control	10/10	10/10	10/10	10/10	10/10	10/10	10/10
Home Defense	4/10	0/10	0/10	0/10	0/10	0/10	0/10
Natural	6/10	4/10	4/10	0/10	0/10	0/10	0/10
Bug Stop	8/10	4/10	2/10	2/10	0/10	0/10	0/10
Bio-Advanced	4/10	4/10	4/10	4/10	2/10	2/10	0/10
Triazicide	0/10	0/10	0/10	0/10	0/10	0/10	0/10

Table 1. Results of the 1st trial are given with (alive/total # of crickets) as our fractions for each column.

2nd Trial							
Pesticide Used	**5 Minutes**	**10 Minutes**	**15 Minutes**	**20 Minutes**	**25 Minutes**	**30 Minutes**	**1 Hour**
Control	10/10	10/10	10/10	10/10	10/10	10/10	10/10
Home Defense	6/10	4/10	2/10	0/10	0/10	0/10	0/10
Natural	4/10	0/10	0/10	0/10	0/10	0/10	0/10
Bug Stop	10/10	6/15	2/10	2/10	0/10	0/10	0/10
Bio-Advanced	2/10	0/10	0/10	0/10	0/10	0/10	0/10
Triazicide	0/10	0/10	0/10	0/10	0/10	0/10	0/10

Table 2. Results of the 2nd trial are given with (alive/total # of crickets) as our fractions for each column.

3rd Trial							
Pesticide Used	**5 Minutes**	**10 Minutes**	**15 Minutes**	**20 Minutes**	**25 Minutes**	**30 Minutes**	**1 Hour**
Control	10/10	10/10	10/10	10/10	10/10	10/10	10/10
Home Defense	2/10	1/10	0/10	0/10	0/10	0/10	0/10
Natural	2/10	1/10	1/10	1/10	1/10	0/10	0/10
Bug Stop	6/10	1/10	0/10	0/10	0/10	0/10	0/10
Bio-Advanced	1/10	0/10	0/10	0/10	0/10	0/10	0/10

Triazicide	5/10	2/10	0/10	0/10	0/10	0/10	0/10

Table 3. Results of the 3rd trial are given with (alive/total # of crickets) as our fractions for each column.

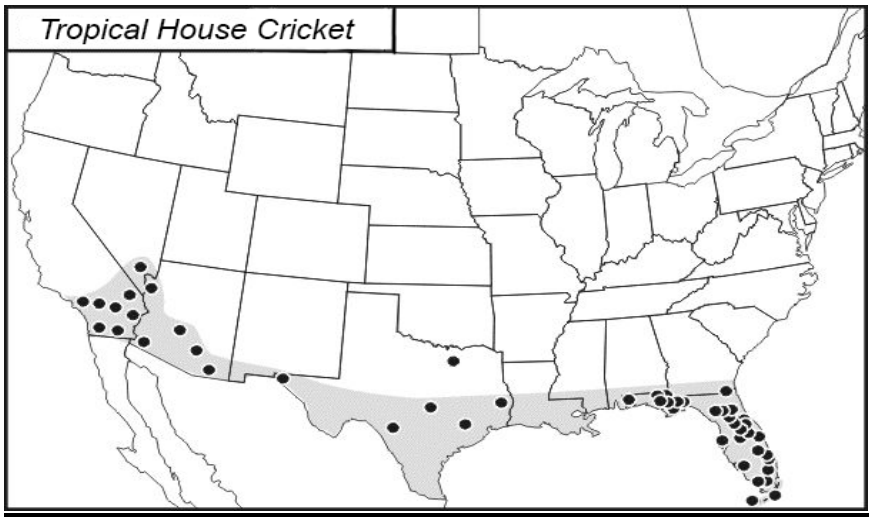

Fig. 1. A map of the US, illustrating the the national distribution of *Gryllodes sigillatus* and the common clustering areas of the Southern bordering states. The map used is from the article Tropical House Cricket, Gryllodes sigillatus by F. Walker from the University of Florida.

Fig. 2. Dorsal view of large adult *Gryllodes sigillatus.*

Fig. 3. Lateral view of large adult *Gryllodes sigillatus.*

Fig. 4. Frontal view of the head and mouthparts of *Gryllodes sigillatus.*

Results and Discussion

The results of this research were used in the development of understanding the effects of chemical and natural pesticides on about 180 *Gryllodes sigillatus* crickets since we had about 20 of our control group died during the experiment. This experiment was conducted in three trials in order to maintain consistency with the data collected during each trial. After our experiment was done, we came to the conclusion that the most efficient pesticide was the Triazicide pesticide. It was one of the four chemically based pesticides used, and one of the most commonly purchased pesticides on the market. The natural based pesticide however did not trail far behind with its results and was a better option than most of the other chemically based pesticides we used. This was very surprising to us since most of the ingredients were easily found at home, and the majority of the pesticide was made up of water. We were not expecting the natural pesticide to work as well as it did and hypothesized that one of the name brand pesticides would be the most efficient. Even though our hypothesis was correct, our overall results proved that natural pesticides are just as efficient and can serve as an alternative to harmful chemical pesticides. The use of chemically based pesticides is the most common solution to getting rid of common household pests, however, the effects that certain chemicals can have on our health should not be taken lightly. Pesticides are made from dangerous chemicals that can put our health at risk and increases the risk for developing potential long-term health conditions. As of now, there are about 1600 types of pesticides available online, instores, and markets (Srivastava, Kesavachandran, 2019). Although there are some benefits to using pesticides, they are still toxic to many animals and humans and can cause severe damage to the normal physiological, biochemical, and pathological condition of an organism. While some of the symptoms do not seem harmful such as headaches, other long term effects can be irreversible such as convulsions, comas, and vision problems (Srivastava, Kesavachandran, 2019). The presence of pesticide residue in drinking water, clothes, crops, and food are often common ways people fall ill and in some cases die, in fact about 20,000 deaths have occured due to pesticide exposure (Srivastava, Kesavachandran, 2019). Proper handling and protective measures should always be taken when using any sort of pesticides, where they are common household pesticides or pesticides used to large commercial treatments. Exposure, even for a short duration can cause damage and enter an organism’s body through the skin, lungs, or mouth, which is why limiting your exposure to harmful chemicals is always the best recommendation. That being said, natural pesticides that can be made from common household items are not harmful and should be used as alternatives for name brand pesticides. Our experiment proved that the natural pesticide used against the chemically based pesticides worked just as efficiently, and even better than come of the other pesticides. The use of natural pesticides, especially when trying to get rid of pests indoors should be used in replace of harmful and expensive chemicals. Not only would this be a great solution for controlling and getting rid of pests, but it will also ensure a safe environment for individuals handling the pesticide. The risk of developing future medical issues would decrease, and accidental exposure would not have to be a major issue, since most of the

ingredients you can use are safe if exposed to accidently.

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