

Comparing Natural Insect Repellents Effectiveness in Preventing the House Cricket, *Acheta domestica* from Consuming Crops from Gardens

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Abstract:

Acheta domestica poses a problem to agriculture and indoor living, as they feed on crops and fabrics. Preventing an infestation begins with preventing this pest from entering susceptible areas in the first place, therefore an effective repellent is necessary. Using a naturally occurring plant ensures little to no harm to the ecology around a garden, farm, or home, unlike using large, scheduled doses of pesticides. The experiment was performed within a cardboard enclosure, wherein a food and water source were surrounded by a ring of natural repellent, which was composed of either chili powder, minced garlic, or nicotine powder. Of the three repellents, chili powder performed the best with 67% success, discouraging the cricket from approaching the food and water. Because *Acheta domestica* is not the only species of cricket that troubles crop production, additional experiments need to be performed to find a natural repellent that works effectively across multiple species on a larger scale.

Keywords: House Crickets, Acheta, Natural Insect Repellents, Agriculture

Introduction:

The House Cricket, *Acheta domestica* can be commonly found all over the eastern portion of the United States, even though it is native to several areas in southwestern Asia (Walter, 2019). The introduction of these insect to North America first occurred in the 18th century due to the Europeans migration to America. It is rare for these insects to bite humans since their mouthparts cannot puncture human skin, and therefore are not considered to be harmful or dangerous. However these insects can still cause tremendous agricultural and household damage. It has been suggested that these pests can act like locusts in a garden, since

they leave holes all over plants and consume their seeds. They also like to feed on household fabric such as clothing, bedding, and even wallpaper (Houseman, 2015). As if this was not bad enough, they also can be a nuisance due to how vocal they are night when chirping to attract any females within the area. Due to these factors, most individuals attempt to prevent these insects from entering their houses or gardens at all costs. However, these insects to this day are still being introduced to different habitats worldwide. This is due to the fact that in 1950 they became the standard feeder insects for the pet and research industries worldwide (Wikipedia, 2019). Therefore as a result, it's

most likely that future management techniques will need to be implemented in order to prevent these insects from spreading further and possibly damaging other ecosystems.

Methods for Identification:

The species of House Crickets that were collected from Petco in College Station, Texas were all examined using a Carson MagniView 2x Power Compact and Lightweight Handheld Magnifying Glass that has a 4.5x Spot Lens (DS-36). In order to identify if these all these crickets were from the species, *Acheta domestica*, a written key called *The Field Guide to Grasshoppers, Katydid, and Crickets of the United States* was used (Capinera, 2004). By using the magnifying glass and the written key, we were able to determine that all the specimens were indeed of the species *Acheta domestica*. This was due to the fact each specimen was light-brown tan in color and had three transverse bands on the top of their heads and between the eyes; all of which are identifying characteristics.

Methods for Collecting:

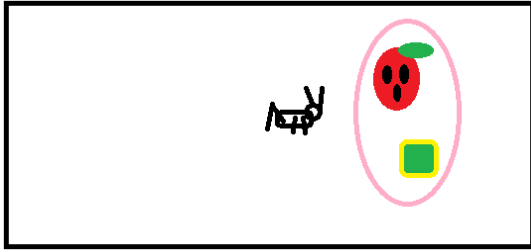
By driving to the nearest Petco in College Station, Texas our group was able to obtain the House Crickets by talking to an employee within the store. The Petco employee then put on a pair of blue latex gloves and using a plastic and metal spatula scooped the insects from their small dark environment in the store into a new clear plastic bag. After counting approximately 25 crickets, she then put in a broken up brown egg carton into the plastic bag to provide the crickets shelter and then sealed the plastic bag with a tight knot

using the bags edges. These crickets were then purchased and taken home so they could be identified and be used to run the experiment. Upon arriving home, 6 of the crickets were placed into a red plastic cup and labeled the Control Group, while the rest of the crickets were divided into groups of 6. Three groups of 6 were formed, and then each group was placed into three red plastic cups labeled either the Chili Group, the Minced Garlic Group, or the Nicotine Group. It should be noted that one cricket was left in the plastic bag in case of one of the other crickets became unresponsive or died to mishandling errors.

Methods for Testing Natural Insect Repellents: Chili, Garlic, and Nicotine

A total of 24 trials were run, each group undergoing 6 trials, and each trial of which used a new cricket. Each trial was performed under the same standard conditions, using a 10 x 4 x 4 inches brown cardboard box. In each cardboard box a small piece of apple with seeds was placed on one side with a piece of a green sponge soaked in water. The apple and sponge were then surrounded very tightly with a line of natural repellent (Chili Powder, Minced Garlic, or Nicotine Powder) as well as partially coated. Upon the completion of setting up the experiment, one cricket was then placed about two to three inches close to the bait and a timer was set for 6 minutes. See Figure 1.

Figure 1: Cricket, Apple, Sponge, and Natural Insect Repellent Placement



Key: Cricket (1) Apple (2) Sponge (3) Cardboard Box(4) Natural Repellent (5)

Results:

In this experiment, three different natural insect repellents were used in order to test each of their effectiveness in preventing House Crickets from eating valuable crops and fabric materials. The three natural insect repellents that were used include Chili Powder, Minced Garlic, and Nicotine Powder. As stated earlier, a total of 24 trials were run, each group undergoing 6 trials, and each trial of which used a new cricket. It took a total of around 2 hours and 30 minutes to conduct the experiment, which includes setting up the experiment as well as conducting the trials. For the control group, 4 crickets hopped onto the apple or sponge while 2 crickets seemed to ignore it and turned away. The natural insect repellent that prevented the least number of crickets from eating the apple or sponge was the minced garlic, with an overall effectiveness rate of 16%. While on the other hand the natural insect repellent that prevented the greatest number of crickets from eating the apple or sponge was the chili powder, with an overall effectiveness rate of 67%. Therefore, from the results we can determine that chili powder is the more effective in deterring and

preventing house crickets from eating crops or fabric while the minced garlic seems to be the least effective in preventing house crickets from eating crops or fabric. See Table 1.

Table 1: Experimental Data Collected from Each Group

Natural Insect Repellent Test Group	Number of Crickets that Crossed to go and Eat the Apple or Sponge	Number of Crickets that Turned Away from the Apple or Sponge	Natural Insect Repellent Test Effectiveness in Deterring Crickets
Control	4	2	33%
Chili Powder	2	4	67%
Minced Garlic	5	1	16%
Nicotine Powder	3	3	50%

Discussion:

In conclusion, the objective of this experiment was to test the effectiveness of some natural insect repellents in deterring and preventing the House Cricket, *Acheta domestica* from eating fruits or fabrics. While this experiment may not be as useful as it could of been since it was conducted using House Crickets, it is still believed that a similar outcome would occur if more important crickets were used such as Field

Crickets. Regardless of the cricket, each year from August to September several cricket outbreaks occur, and as a result during these times these overgrown populations may damage local crops or fabrics (Hallet, 2014). As a matter of fact, each year it is estimated that crickets cause around \$5 billion in damages in the United States (TICB, 2017). Thus, in order to control this unmanageable issue, more insect repellents should be used. However, most synthetic insect repellents of today tend to damage the environment or disrupt the ecosystem.

As a result, in order to control these cricket populations as well as protect the environment from the harmful effects of synthetic insect repellents, natural insect repellents should be used instead. According to the results of the experiment, natural and more organic insect repellents like Chili

Powder, Minced Garlic, and Nicotine Powder may be used to deter and prevent crickets from consuming crops or fabrics. After conducting the experiment, it seems that Chili Powder is the best natural insect repellent with an effectiveness rate of 67%, while Nicotine Powder is the next best natural insect repellent with an effectiveness rate of 50%, and Garlic is the worst natural insect repellent with an effectiveness rate of 16%. Therefore, if an individual wanted to prevent insects from eating their fruits or vegetables in their gardens or fabrics in their households, it would seem that Chili Powder alone or a mixture of Chili Powder and Nicotine Powder would be the best options. It should be noted that these tests were done on a smaller scale, and in order to see if they would be effective at controlling larger cricket populations, larger experiments would need to be conducted.

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