

Ant Restaurant: Fire Ant Attraction to Varying Food Groups

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Abstract: *Solenopsis invicta* or the red imported fire ant is a well-known and common pest in Texas. They can be seen in many different grassy habitats and affect both people and animals. Their most distinctive feature is the red head and thorax and black abdomen. Due the aggressiveness of this species of fire ant, it is often very sought after how to get rid of them, especially when they invade homes. It is often annoying to see ants all over any type of food that is left outside. However, this can be used as an advantage to get rid of them. Baiting is a very affective technique; it is just important to know what attracts them the most. This experiment tests 8 different foods, with differing carbohydrate, protein and lipid contents to see which are the most attractive to ants. Three different “plates” will act as three different trials and the number of ants of each food on each plate will be counted. A system of how ants are counted is also specified to make sure they don’t get counted twice. Finally, based on these results, inferences on which baits would be the most effective can be discussed. In addition, the contents an ideal bait can also be explained as well, leading to further research on *Solenopsis invicta* baiting techniques.

Key Words: Fire ant (*Solenopsis invicta*), colony, mound, attract

The imported red fire ant (*Solenopsis invicta*) is an important pest in Texas and across North and South America. These are also classified as an invasive species and are negative for human health (Gunawardana 2014). This is due to the aggressive worker ants. These ants gather food outside of the mound and provide some protection (Texas A&M Agrilife 2012). Worker ants are dangerous because they will use their mandibles to bite and their venomous stingers to sting multiple times (Gunawardana 2014). In addition, about 14 million people have been stung annually with more than 80 deaths due to an allergic reaction (Gunawardana 2014).

To control the population of *Solenopsis invicta*, baiting is one of the most effective methods of detection and getting rid of colonies (Gunawardana 2014). Therefore, the diet of this fire ant is very important for how to get them to be attracted to the bait. *Solenopsis invicta* are omnivores and their diet is a mixture of sugars, protein and fats (US Department of Agriculture n.d.). For example they will feed on other insects and sweet liquids such as nectar and honeydew (US Department of Agriculture (n.d). Worker ants also have the ability to carry solid and liquid foods due to their biting and sipping mouthparts (Gunawardana 2014). Therefore, they can transfer pretty much any form of food back to their mound. In addition, protein and sugar baits are also the most

recommended (Gunawardana 2014). Therefore, a wide range of foods can be used for attraction it is just the matter of finding which one is the most attractive. One example of a common bait technique is using a toxicant in soybean oil on top of corn grit (Riggs 2002). This is very attractive to ants due to not only its contents, but the oil and grease.

The purpose of this experiment is to find the foods types (carbohydrates, proteins and fats) that will be the most attractive to ants. Therefore, foods with a high sugar content such as honey, candy and syrup will be tested. Also, leaf- like foods can also be used due to there being a moderate number of plants in their diet (US Department of Agriculture n.d.). Finally, foods that have a strong smell can also be tested, due to them finding food using pheromone signals (Riggs 2002). Finally, foods that are high in protein should also be tested. The information gathered from this experiment can also be used for further experimentation on creating the ideal bait for *Solenopsis invicta* for prevention and control of this pest.

Materials and Methods

Food Samples

8 different foods from were used and included honey, maple syrup, Haribo gummy bears, pickled jalapenos, cooked egg, orange slices, shredded cheese, and iceberg lettuce. Honey, maple syrup and Haribo gummy bears and orange were picked due to their sugar content. Honey has 0.824 grams of sugar per gram, maple syrup

has 0.56 grams of sugar per gram and Haribo gummy bears has 0.46 grams of sugar per gram (Food Data Central 2019). The cooked egg and shredded cheese were picked due to their protein content with 0.124 grams protein per gram and 0.25 grams protein per gram respectively. In addition, cheese has a lipid content of 0.19 grams per gram of cheese. The pickled jalapeno was picked due to its strong smell.

Experimental Procedure

Each of the “plates” were made from cardboard and each food was spread out evenly on the cardboard. This should be done three times. In addition, the foods were placed in different spots (closer or farther from the edge) for each trial. These plates were then placed around a fire ant colony and left. Every 10 minutes, the plates were checked and the number of ants at each food were counted. After 100 minutes the counting ended, and total number of ants was calculated. In addition, during those 100 minutes, careful observations of the ant behavior with the food groups should be notes, in addition to if there are other species of ants that are attracted.

Quantitative Procedure

How the ants were counted also needs to be addressed. The baseline for if an ant was counted for was if it was feeding on or stopped in the drawn circle of the subsequent food. Also, only the number of new ants that grabbed food were counted in addition to if an ant grabbed a piece of food and took it back to the colony.

Unexpected Problems

One of the most difficult aspects of this experiment was finding an active fire ant colony. This is since in the winter ants are more dormant (Berman 2010). In addition, they will dig deeper under their mounds, making finding them on the ground less likely (Berman 2010). Therefore, waiting for warmer weather was essential for finding active ants that were looking for food.

Results

Each of the totals as shown in Figure 1 is the total number of new fire ants counted in 100 minutes. For the raw data for each trial and averages refer to Table 2, 3 and 4 and Figure 2, 3, and 4. The food group with the largest number of ants is the shredded cheese with an average of almost 90 ants. In addition, honey, maple syrup and cooked egg also had a similar number of ants, around 30 total. On the other hand, the gummy bear, pickled jalapenos, orange slice and romaine lettuce attracted very little fire ants.

Observations

One important observation that was needed throughout all three trials is that after 1 hour of the food being left out, only the shredded cheese seemed to be taken back to the colony. It took about 5-10 ants to take pieces of shredded cheese back to the colony, which were all counted in the totals. In addition, during Trial 2 and 3, the cooked egg started to be taken back to the colony at the 70-minute mark.

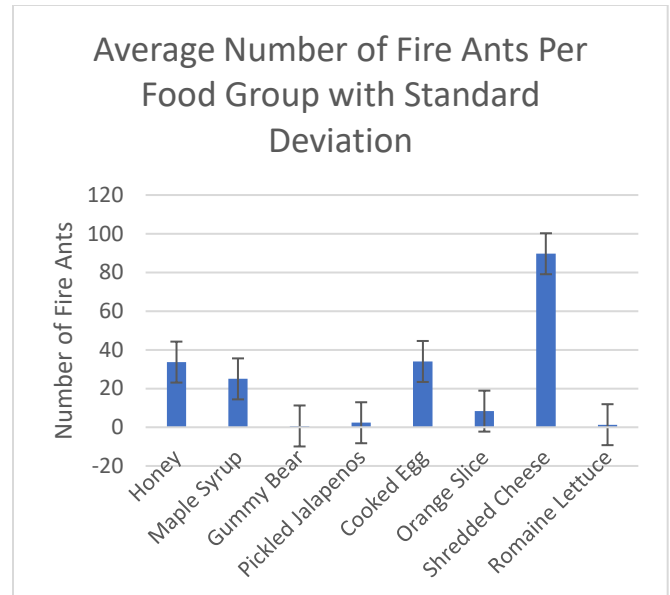


Figure 1: Average Number of Fire Ants for Each food group

Another observation is that in all three trials, when the ants were attracted to the maple syrup and honey, they would stay with that respective food longer than that of the other foods. It is also important to note that at the 80-minute mark for Trial 1, there were about 30 odorous house ants (*Tapinoma sessile*) were identified on the maple syrup (Texas A&M Agrilife 2012). These were identified by being smaller in size than that of the fire ant (Texas A&M Agrilife 2012). Also, they were all black in color and thus lacking the distinctive red color of the fire ant. These were not counted towards the total of ants due to those ants being a different species. Finally, by the end of the 100 minutes, for Trial 3, all of the shredded cheese pieces had been taken back to the colony and thus none were left on the cardboard plate.

Discussion

The data shows that the shredded cheese was the most attractive to the ants. This could be because ants are attracted to greasy and fatty foods (Riggs 2002). In addition, this cheese had the highest content of protein and had a high fatty acid content as well. It was also observed that the cheese pieces were carried back to the mound more than any of the other foods. This could be due to the small pieces being easy to move. For a relation to ant bait techniques, bait needs to be able to be taken back to the queen in order for the colony to die out (*Tips for effective ant baiting 2018*). This will require the bait to be a small amount of food that is easily carried, which is why the shredded cheese pieces were very attractive as well. One popular bait that contains a high amount of protein is a paste bait (Cornell College of Agriculture and Life Sciences n.d.). Due to the large attraction of ants to the shredded cheese, an ideal bait of *Solenopsis invicta* includes a high content of protein and fatty acids.

Honey and maple syrups were also two of the more popular foods. This could be because of their sugar content, which is similar to their natural diet of nectar and honeydew. Honeydew contains both sugar and amino acids with it being at most 80% sugar (Fischer and Volkl and Hoffmann 2015). Similarly, nectar can have a sugar content of 10% to 80% (Nardone, Dey, Kevan 2013). In addition, it is easier for the

ants to ingest and transfer this liquid food as well. This could also be a reason that the Haribo gummy bear had very little ants attracted to it. This also had a high sugar content; however, it was in one large piece that would take a large amount of energy to transfer or break down into smaller pieces. In addition, liquid and gel baits that will taste like honeydew are also available for containment of ant populations (Cornell College of Agriculture and Life Sciences n.d.). However, these are more suited to ants such as *Tapinoma sessile* that have more sugar in their diet. This was seen in the observation of odorous house ants being attracted to the maple syrup. The red imported fire ant was attracted to these foods with high carbohydrate content, but for an ideal bait for them, it should be less than the fatty acid and protein content.

For further research, having the right balance of carbohydrate to protein to fatty acid content is important for the ants to not only be attracted but also be able to transfer it back to the queen (Cornell College of Agriculture and Life Sciences n.d.). This can be seen in granular or solid ant baits (Cornell College of Agriculture and Life Sciences n.d.). Even, further research needs to be done on the exact amount of each food group, this experiment supports the hypothesis that there should be the most amount of protein and fatty acids present in the bait for it to be the most attractive to *Solenopsis invicta*.

Supplemental Material

Table 1: Averages of all Three Trials

Total Number for Fire Ants	Trial 1	Trial 2	Trial 3	Average
Honey	51	20	30	33.66667
Maple Syrup	32	22	21	25
Gummy Bear	0	2	0	0.666667
Pickled Jalapenos	0	1	6	2.333333
Cooked Egg	42	30	30	34
Orange Slice	4	14	7	8.333333
Shredded Cheese	110	86	73	89.66667
Romaine Lettuce	1	3	0	1.333333

Table 2: Trial 1 Raw Data

	Food	Honey	Maple Syrup	Gummy Bears	Pickled Jalapenos	Cooked Egg	Orange slice	Shredded Cheese	Romaine Lettuce
Time (min)	Number of new ants								
10		0	0	0	0	0	0	1	0
20		0	0	0	0	0	0	0	0
30		0	0	0	0	0	0	1	1
40		6	1	0	0	0	0	1	0
50		4	6	0	0	0	0	0	0
60		11	16	0	0	0	0	2	0
70		0	0	0	0	5	1	30	0
80		14	5	0	0	6	0	20	0
90		0	0	0	0	8	3	30	0
100		16	4	0	0	23	0	25	0
Total		51	32	0	0	42	4	110	1

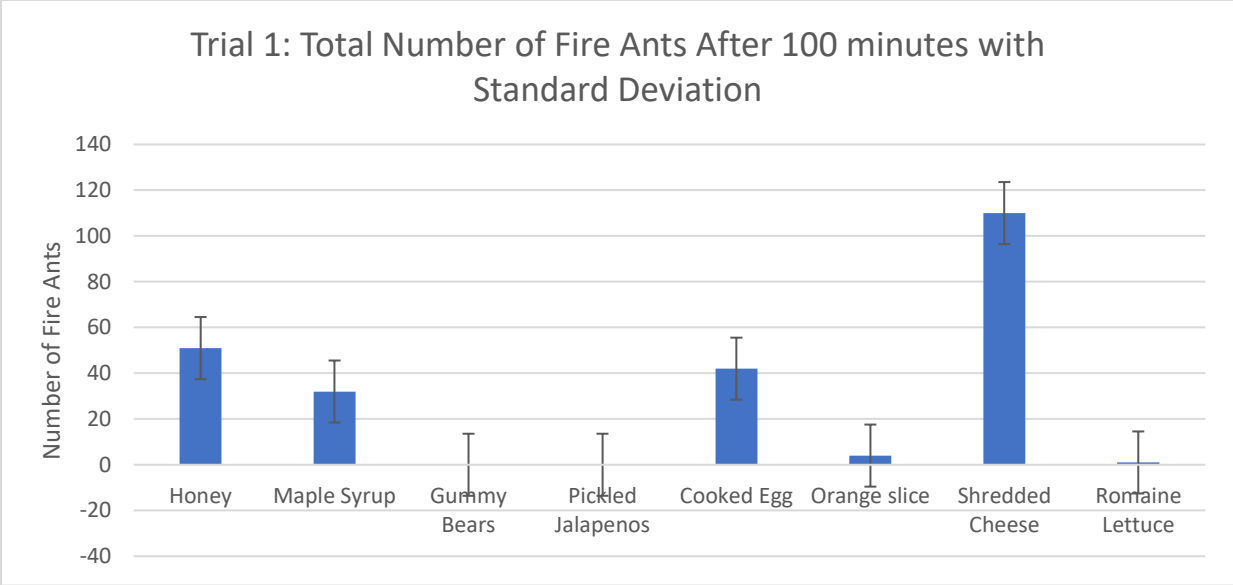


Figure 2: Trial 1

Table 3: Trial 2 Raw Data

	Food	Honey	Maple Syrup	Gummy Bears	Pickled Jalapenos	Cooked Egg	Orange Slice	Shredded Cheese	Romaine Lettuce
Time (min)	Number of new ants								
10		0	0	0	0	0	0	0	1
20		0	0	0	1	0	1	3	0
30		0	0	0	0	0	2	0	0
40		2	4	1	0	0	0	2	0
50		3	5	0	0	2	2	3	0
60		4	3	0	0	6	1	5	0
70		3	1	1	0	2	1	25	0
80		4	3	0	0	0	3	25	1
90		4	4	0	0	2	1	0	0
100		0	2	0	0	18	3	23	1
Total		20	22	2	1	30	14	86	3

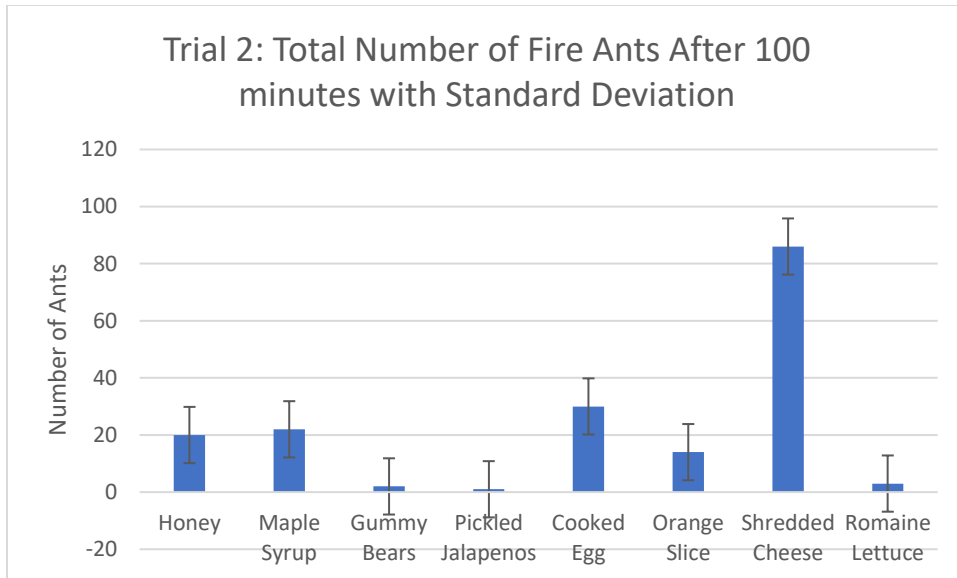


Figure 3: Trial 2

Table 4: Trial 3 Raw Data

	Food	Honey	Maple Syrup	Gummy Bears	Pickled Jalapenos	Cooked Egg	Orange slice	Shredded Cheese	Romaine Lettuce
Time (min)	Number of new ants								
10		0	0	0	0	0	0	0	0
20		0	0	0	0	0	0	1	0
30		0	0	0	0	0	0	0	0
40		0	0	0	1	0	0	3	0
50		4	2	0	0	2	0	7	0
60		4	1	0	0	8	2	17	0
70		5	0	0	3	5	1	21	0
80		8	3	0	0	6	1	5	0
90		3	2	0	2	4	2	19	0
100		6	13	0	0	5	1	0	0
Total		30	21	0	6	30	7	73	0

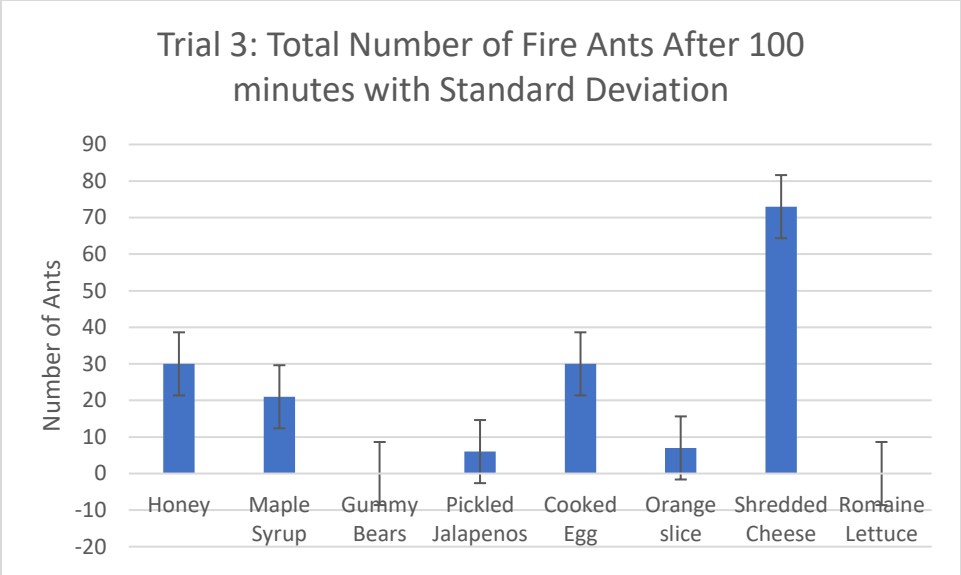


Figure 4: Trial 3

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