

# Testing the Efficiency of Four Homemade Baits for *Solenopsis invicta* (Hymenoptera: Formicidae) (Buren)

Meagan Sheffield

Texas A&M University, College of Veterinary Medicine and Biomedical Sciences

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**Abstract:** Both store-bought and homemade baits can be used to attract and kill ants. The efficiency of four homemade baits - peanut butter, grape jelly, powdered sugar, and dish soap - for attracting *Solenopsis invicta* (Hymenoptera: Formicidae) (Buren) were tested by mixing 1 tsp of baking soda and 1 tsp of each bait in four covered cups. The cups were placed on a mound in Flint, TX for 15 minutes before being placed in a plastic bag and stored for at least 24 hours. Ten identical trials were conducted. The dish soap mixture attracted the highest percentage of ants (53.36 percent  $\pm$  24.058 percent), followed by the peanut butter mixture (28.12 percent  $\pm$  26.02 percent), the grape jelly mixture (11.90 percent  $\pm$  9.398 percent), and then the sugar mixture (6.62 percent  $\pm$  7.475 percent). The dish soap mixture was the most efficient in attracting *S. invicta* although it does not contain sugar or protein, which have been proven to act as efficient ant bait. This result may be due to the paste's ability to trap and suffocate the ants that interacted with it and its grapefruit scent.

*Keywords:* *Solenopsis invicta*, ant, bait, homemade

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*Solenopsis invicta* (Hymenoptera: Formicidae) (Buren), or the red imported fire ant, was brought to the United States through Mobile, AL around the 1930s or 1940s and quickly spread across nine Southern states, including eastern Texas (Lofgren et al. 1975). By 1975, *S. invicta* occupied more than 52 ha of land (Lofgren et al. 1975). Although they make their mounds outdoors, ants often travel into buildings searching for food and

water, coming into contact with humans. These ants pose a health risk for both humans and animals. Bites from *S. invicta* cause a burning sensation, hence their name, and leave a pustule. Some people may also experience a severe systemic allergic reaction to these ant bites (Lofgren et al. 1975). This ant species is also known to carry three different viruses, but none are known to infect any

organisms other than arthropods (Valles and Hashimoto 2009).

*S. invicta* can be controlled chemically using residual control, drenching emulsifiable concentrates and water, and toxic baits that are composed of a food attractant and a toxin (Williams 1983). Borax, boric acid, and hydramethylnon are often used as toxins to kill ants but are dangerous to pets and children. Baking soda is safer to use around pets and children and has been proven to kill other species of fire ants by increasing their internal pH, causing enzymatic dysfunction (Brinkman and Gardner 2004). Baking soda is found in most kitchens and can be used to make homemade bait. Homemade bait can be cheaper than store-bought bait, and during the current COVID-19 pandemic, going to the store to buy ant bait can pose a significant risk of getting infected, if any stores are open at all. *S. invicta* are attracted to foods that include lipids, proteins, and carbohydrates (Stein et al. 1990). A grape jelly/agar mixture (Stein et al. 1990) was proven as an efficient bait for *S. invicta*. A study in Taiwan compared the efficiency of baits using hotdogs, shrimp crackers, potato chips, peanut butter, sugar, pork fat, and butter as *S. invicta* bait, with hotdogs proving the most efficient (Bao et al. 2011). Soap has been used to control pests since 1787, and dish soaps have been tested to determine the amount of detergent needed to drown *S. invicta* floating in water (Chen et al. 2010). More experiments are needed to test a wide variety of homemade baits made with

baking soda and directly compare the amount of *S. invicta* ants they attract.

Therefore, an experiment was designed to test the efficiency of four different homemade baits mixed with baking soda - peanut butter, grape jelly, powdered sugar, and dish soap - on attracting ants from a *S. invicta* mound.

### **Materials and Methods**

*S. invicta* were collected from an outdoor mound (about 1' x .5') located in Flint, TX (32.196491, -95.324684) from April 9-25, 2020 in the afternoon (from 3 to 7 p.m.). The mound was located on an incline and was surrounded by grass. The ant mound had no other human intervention except during collection, and collections only occurred when there was no precipitation or high wind speeds.

Materials used as bait include creamy peanut butter (Hormel Foods Sales, LLC, Austin, MN), natural concord grape jelly (Welch's, Concord, MA), confectioners powdered sugar (Wal-Mart Stores, Inc., Bentonville, AR), grapefruit dish soap (Colgate-Palmolive Company, New York, NY), and baking soda (NaHCO<sub>3</sub>) (Wal-Mart Stores Inc., Bentonville, AR).

Materials used for the bait containers include 9 oz. paper cups (Unique Ind., Inc., Philadelphia, PA), clear cling wrap (The Glad Products Company, Oakland, CA), masking tape (3M, St. Paul, MN), and double zipper gallon plastic bags (Wal-Mart Stores, Inc., Bentonville, AR).

The hypothesis stated was: if the four different baits (peanut butter, grape jelly,

powdered sugar, and dish soap) were placed near a *S. invicta* mound, then the peanut butter bait will attract the highest percentage of ants. The controls include the materials used for each bait container, the amount of bait used in addition to 1 tsp of baking soda, the site of collection, and the amount of time allowed for collection. The variable is the type of bait used.

Four paper cups had four equidistant 1 cm wide holes poked in them to allow ants to access the bait. 1 tsp of baking soda and 1 tsp of each bait were placed at the bottom of four separate paper cups and mixed. Each cup was covered with cling wrap secured with three or four pieces of masking tape. The four cups were placed on top of the ant mound in a line equidistant from each other for 15 minutes before being placed into four separate plastic bags. The number of ants located in each bag were counted at least 24 hours after initial collection until all or most ants were dead to prevent miscounting. This procedure was replicated ten times. Trials interrupted by severe weather or trials resulting in total ants collected being smaller than ten or larger than 500 were not included.

The data collected was added to find totals for each trial. Then, percentages of ants collected were calculated for each type of bait, in addition to sample mean and standard deviation, denoted as (mean  $\pm$  standard deviation). The percentages of ants collected for each trial were put in a stacked column chart,

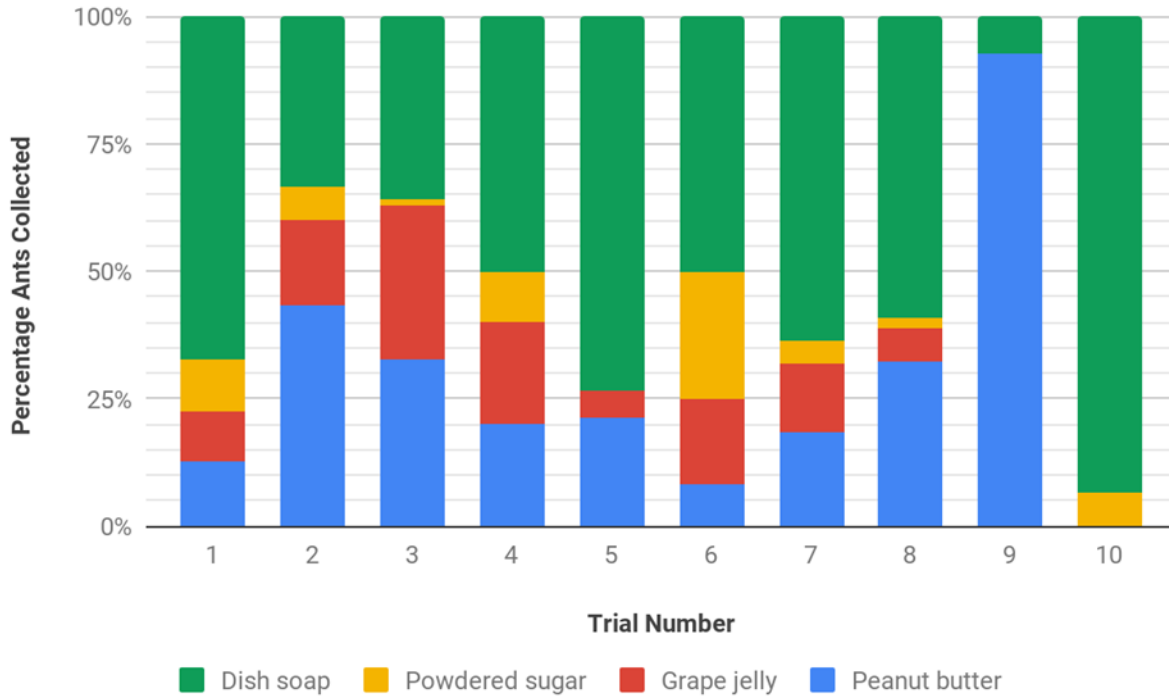
and the ant totals for each trial were put in a bar graph.

## Results

The dish soap mixture attracted the highest percentage of ants (53.36 percent  $\pm$  24.058 percent), followed by the peanut butter mixture (28.12 percent  $\pm$  26.02 percent), the grape jelly mixture (11.90 percent  $\pm$  9.398 percent), and then the sugar mixture (6.62 percent  $\pm$  7.475 percent) (Fig. 1). The dish soap mixture collected the highest percentage of ants for eight of the conducted trials (80 percent), while the peanut butter mixture collected the highest percentage of ants for two of the conducted trials (20 percent). The powdered sugar mixture attracted the lowest percentage of ants for six trials (60 percent). The powdered sugar mixture and grape jelly mixture tied for lowest percentage of ants collected for two trials (20 percent). The peanut butter mixture and grape jelly mixture tied for lowest percentage of ants collected for one trial (10 percent), and the peanut butter mixture attracted the lowest percentage of ants for one trial (10 percent).

398 ants were collected throughout the entire experiment (Fig. 2). Ten to 120 ants were collected for each trial, with an average of  $39.8 \pm 35.96$ . The most ants were collected during trial 1, while the fewest ants were collected during trial 4. More than half of the ants used in the experiment (62.06 percent) were collected during the first three trials, and

four trials (40 percent) attracted more ants than the mean ( $39.8 \pm 35.96$ ).



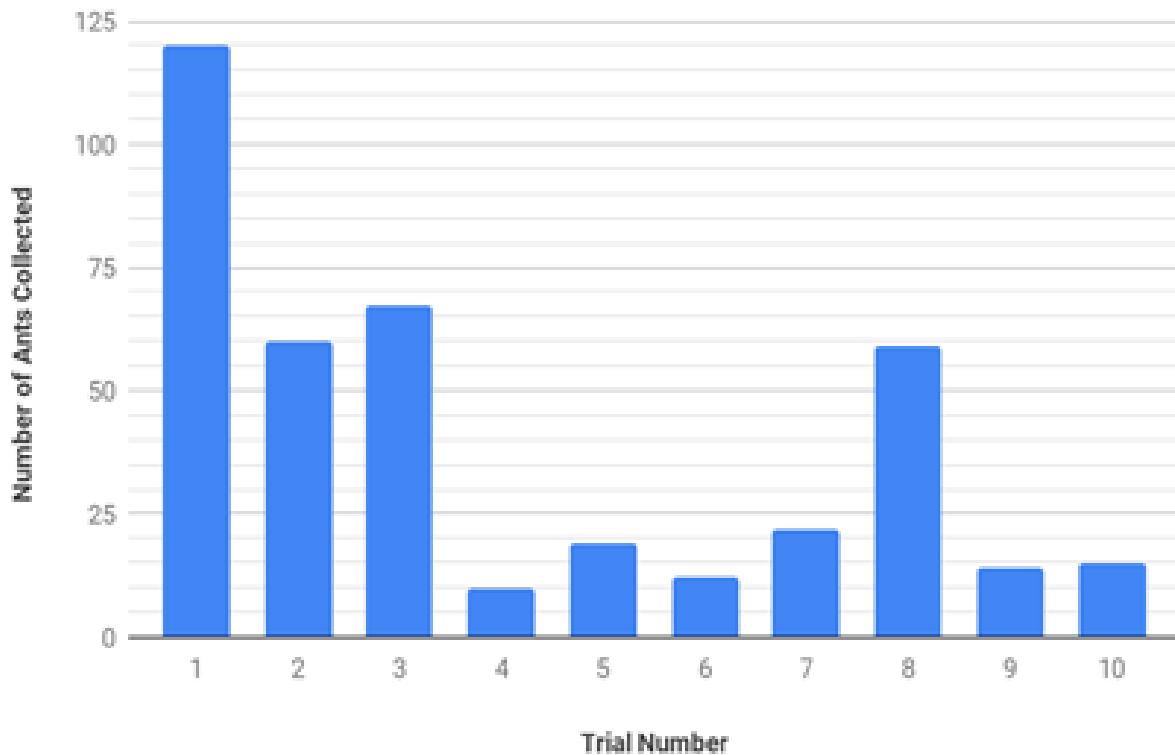
**Fig. 1.** The percentage of ants collected using each bait method (dish soap, powdered sugar, grape jelly, and peanut butter mixtures) for all ten trials are shown in the stacked column chart.

### Discussion

*S. invicta* are one of the most common species of ant found in eastern Texas and can enter buildings to look for food and water. This species has a particularly painful bite when contact is made, so control of these ants is important for human and animal health. One method of control includes baiting, which can be store-bought or homemade. Homemade baits may be cheaper to purchase and can be more easily used around pets and

children. These baits may also be the only option available to those affected by the COVID-19 pandemic. *S. invicta* can be attracted to protein, lipid, and carbohydrate-rich foods. Efficiency of baits tested and compared in previous studies include a grape jelly/agar mixture and tuna fish cat food (Stein et al. 1990), boric acid-sucrose water bait (Klotz 1997), s-methoprene on vegetable oil-coated defatted corn grit carrier (Calixto 2007), and soybean oil (Kidd et al. 1985).

However, no previous study has investigated and compared the efficiency



**Fig. 2.** The total number of ants collected using all four bait types for all ten trials are listed in the bar graph.

of peanut butter, grape jelly, powdered sugar, and scented dish soap mixed with baking soda as food ant baits by counting the number of ants attracted to each method.

The dish soap mixture was determined to be the most efficient in attracting *S. invicta*, followed by peanut butter, grape jelly, and powdered sugar. Dish soap contains a mixture of water and detergent, peanut butter contains both protein and carbohydrates (73 percent fat, 14 percent protein, and 12 percent

carbs), and grape jelly and powdered sugar contains sugar (100 percent carbs). Sugar, protein, and oil have been proven as effective baits for *S. invicta*, but protein-based baits are more effective during the hotter months, while ants prefer the sugary baits during the colder months (Stein et al. 1990). Because this study was conducted in April, this could explain why 28.12 percent  $\pm$  26.02 percent of the ants in the experimental sample were attracted to the peanut butter and why the grape jelly and powdered sugar displayed lower

percentages. Although dish soap does not contain sugar or protein, the paste it created when mixed with baking soda trapped and suffocated more ants than the other baits. The grapefruit scent may have also contributed to how many ants were attracted to it. Ants have been observed to be attracted to the smell of hot dog slices (Drees 2011) and are known to feed on citrus trees, including grapefruit (Smittle 1988). *S. invicta* are also more attracted to liquid baits than dry baits (Stein et al. 1990). Following homemade *S. invicta* studies should use more baits composed of a paste-like texture or different scents of dish soap to

determine which attracts the most ants. Use of this type of bait could be extended to a larger-scale study.

In summary, the dish soap mixture is the most efficient bait to use for *S. invicta* in comparison to peanut butter, grape jelly, and powdered sugar.

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## Literature Cited

- Bao S. Z., L. Kafle and C. J. Shih. 2011.** A new baited trap for monitoring *Solenopsis invicta* (Formicidae: Hymenoptera) in Taiwan. *Appl Entomol Zool.* 46:165-169.
- Brinkman M. A. and W. A. Gardner. 2004.** Mortality of Ant (Hymenoptera: Formicidae) Pest Species Exposed to Sodium Hydrogen Carbonate. *Fla Entomol.* 87(3):324-329.
- Calixto A. A., M. K. Harris, A. Knutson, and C. L. Barr. 2007.** Native Ant Responses to *Solenopsis invicta* Buren Reduction Using Broadcast Baits. *Environ Entomol.* 36:1112-1123.
- Chen J., H. W. Shang, and X. Jin. 2010.** Response of *Solenopsis invicta* (Hymenoptera: Formicidae) to potassium oleate water solution. *Insect Sci.* 17:121-128.
- Drees B. M. 2011.** Seeing Fire Ants Smell: Olfaction of *Solenopsis invicta*. *Southwest Entomol.* 36(4):395-399.
- Kidd K. A., C. S. Apperson, and L. A. Nelson. 1985.** Recruitment of the Red Imported Fire Ant, *Solenopsis invicta*, to Soybean Oil Baits. *Fla Entomol.* 68(5):253-261.
- Klotz J. H., K. M. Vail, and D. F. Williams. 1997.** Toxicity of a Boric Acid-Sucrose Water Bait to *Solenopsis invicta* (Hymenoptera: Formicidae). *J Econ Entomol.* 90(2):488-491.
- Lofgren, C. S., W. A. Banks, and B. M. Glancey. 1975.** Biology and Control of Imported Fire Ants. *Annu Rev Entomol.* 20:1-30.
- Smittle, B. J., C. T. Adams, W. A. Banks, and C. S. Lofgren. 1988.** Red Imported Fire Ants: Feeding on Radiolabeled Citrus Trees. *J Econ Entomol.* 81(4):1019-1021.
- Stein M. B., H. G. Thorvilson, and J. W. Johnson. 1990.** Seasonal Changes in Bait Preference by Red Imported Fire Ant, *Solenopsis invicta* (Hymenoptera: Formicidae). *Fla Entomol.* 73(1):117-123.
- Valles, S. M. and Y. Hashimoto. 2009.** Isolation and characterization of *Solenopsis invicta* virus 3, a new positive-strand RNA virus infecting the red imported fire ant, *Solenopsis invicta*. *Virol Rep.* 388(2):354-361.
- Williams, D. F. 1983.** The Development of Toxic Baits for the Control of the Imported Fire Ant. *Fla Entomol.* 66(1):162-172.