Evaluation of Chemical Treatments against the black carpenter ant (*Camponotus pennsylvanicus)*

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The ant *Camponotus pennsylvanicus* plays a beneficial role ecologically because these ants nest in dead wood and aid in its decay. However, the *Camponotus pennsylvanicus* ants are a common pest. They can damage the structure of houses and other infrastructure. Therefore, ensuring the pest is controlled is an important issue. Current *Camponotus pennsylvanicus* control measures include baits, chemical treatments, and preventative sprays (Carney 1969). In this experiment, four commonly used and readily available killing agents were tested, each with a different chemical makeup (Theil and Köhler 2016). The four different killing agents used were dimethyl benzyl ammonium chloride (Hot Shot), imiprothrin (.060%) (Raid), prallethrin (.02%) (No Pest), and water ammonium lauryl sulfate (Ajax/ water). The ant killing agents were tested by collecting the *Camponotus pennsylvanicus* ant in petri dishes. Eighty specimens were collected and these specimens were separated into four groups which were each exposed to one of the four different ant killing agents during three individual trials. The efficiency of each pesticide was evaluated by comparing the total averaged percent of killed ants for each killing agent gathered from the trials conducted. Data collected indicated that dimethyl benzyl ammonium chloride is the most effective pesticide among the chemical treatments used against *Camponotus pennsylvanicus.*

Keywords**:** Black carpenter ant, *Camponotus pennsylvanicus*, dimethyl benzyl ammonium chloride, imiprothrin, prallethrin, water ammonium lauryl sulfate

Ants are common household pests that wander into your home when least expected. People usually find themselves looking for common home remedies to be rid their unwanted guests, or even head to the nearest Home Depot to find a repellant to kill them quickly (Klotz and Moss 1996). With there being many ways to kill ants, how does one know which product is most effective? Our experiment focused on the chemical components and trap styles of different ant and pest killers to determine which product was the most effective in killing off ants. This experiment could help millions of people save money by purchasing the most effective product to exterminate their pests (Tripp, Suiter, Bennett 2000).

Materials and Methods:

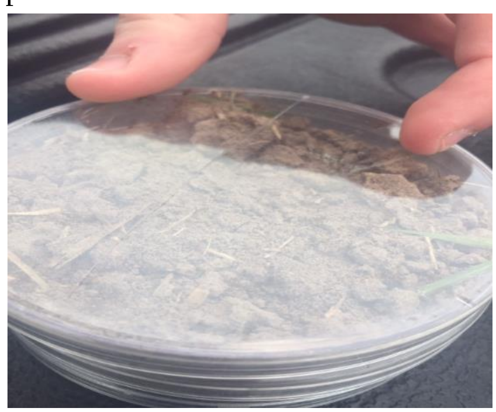
The experiment conducted tests the effectivity of killing commonly found carpenter ants in central and eastern Texas based on chemical makeup of several commercial killing agents, along with a homemade remedy. Several different products will be used to kill the ants. The first of these being Hot Shot ant/roach killer (Spectrum Brands Inc., Madison Wisconsin); the major component of this product's active ingredients is Dimethyl Benzyl Ammonium Chloride, and can be found at local stores, such as Home Depot. Following this test, a Raid Ant Bait (Johnson & Son Inc., Racine Wisconsin) will be the next product tested. This product has an active chemical makeup of mostly Imiprothrin. It can also be bought at local stores. Thirdly, an agent by the brand name No-Pest (Spectrum Brands Inc., Madison Wisconsin) will also be tested. This spray relies mostly on the compound Prallethrin in order to kill ants. The final agent to be used in this experiment will be an Ajax dish soap (Colgate-Palmolive, New York City New York) and water combination (Marshal 2016). Such a mixture is mostly composed of Ammonium Lauryl Sulfate, along with the water being mixed in to activate it. The ants used for testing were all collected from a single ant hill (Carlin and Hölldobler 1986).

Once the respective pesticides were gathered (Figure 1. D.), the specimens were collected. All specimens will be taken from the same ant hill in order to maintain same species throughout (Banks, Lofgren, Jouvenaz, Stringer, Bishop, Williams, Wojcik, and Glancey 1981). A shovel will be used to transfer the ants into a jar. 80 specimens will be collected and split into four groups of 20. Each group of 20 will be further split into two groups of 10, each group isolated in separate petri dishes. (Figure 1. A. & Figure 1. B.) One petri dish will be treated with a specific ant-killer product and the other dish will be used as a control group. This way, a control group for each group of ants collected from different locations will be available to compare to. Pesticides will be inserted so that the soil in the petri dishes becomes soggy, not flooded (Figure 1. C.). Ants will be timed for 10 minutes before results are recorded. The test will be repeated three times with new ants and petri dish to ensure accuracy of results.

While observing the effects of the pesticides on the specimens, a record will be taken of how many ants were killed after each trial due to each pesticide for statistical analysis . After all of the trials are completed, the average number of ants killed per trial will be recorded, as well as the average percent dead for each of the pesticides. Data will help identify which pesticide is the most effective in ant extermination.

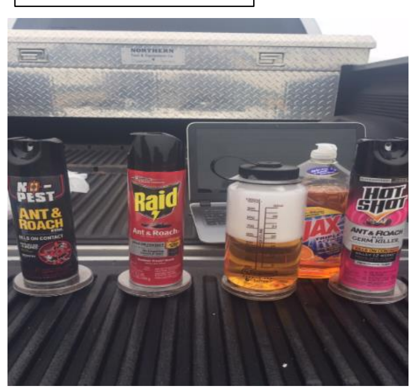
Figure 1.: A. & B. Petri dishes with soil. C. Soggy petri dish. D. Pesticides

(Figure 1. A.).



(Figure 1. B.).

(Figure 1. C.).



(Figure 1. D.).

Results:

Table 1: Experimental Data

Killing Agent	Primary Active Ingredient	Number Dead (Trial 1)	Number Dead (Trial 2)	Number Dead (Trial 3)	Total Dead (out of 60 specimens)	Average Dead per Trial	Average percentage Dead (Per Trial)	Total % Dead
Hot Shot	Dimethyl Benzyl Ammonium Chloride (.055%)	20	20	20	60	20	100%	100%
Raid	Imiprothrin (.060%)	20	19	20	59	19.67	98.30%	98.30 %
No Pest	Prallethrin (.02%)	18	19	18	55	18.33	91.67%	91.67 %
Ajax/ Water	Water Ammonium Lauryl Sulfate	13	18	15	46	15.33	76.67%	76.67 %

Within this experiment, four different killing agents were tested methodically for their efficiency in eliminating confined carpenter ants. The four agents that were tested are Hot Shot, Raid, No Pest, and an Ajax/Water mixture. Within these agents, the primary active ingredients were Ammonium Chloride, Imiprothrin, Prallethrin, and water/ammonium along with Lauryl Sulfate respectively. For the experimental apparatus, twenty ants were used in three separate trials for a grand total of sixty ants. For trials 1 through 3, Hot Shot killed an average of twenty ants per trial being 100% effective The Raid had a very similar yield with a total of fifty-nine ants. On average each of the three trials yielded 19.67 ants dead with a mortality rate of 98.3%. The No Pest killed a total of fifty-five out of sixty ants with the average being 18.33 ants per trial and a 91.67% mortality rate. The Ajax/Water mixture had the least effective results with a mere forty-six ants out of the sixty dead. The average per trial would come to 15.33 and a 76.67% mortality rate.

Discussion:

After concluding this experiment, there were a number of variables that could be improved within the experimental apparatus. When testing the effectiveness of the chemicals, it would be more realistic if the ants were spread out over a larger surface and a way was found to evenly distribute the chemicals (Callcott and Collins 1996). This would be important because this is a more likely situation that would be encountered in a day-to-day scenario (Suckling, Stringer, Stephens, Woods, Williams, Baker, and El-Sayed 2016). When interpreting the overall purpose of this experiment, it is apparent that there are a number of uncontrollable variables and untested questions. This test benefits ant pesticide research because by using the data presented future studies could be done that complement these results by finding the minimum amount of ant-killer that would be required to kill a set number of ants in an allocated area (Kingston, Hall, Sioris 2008). This is a simple experiment that can be run to help expand the understanding of the effect of any number of pesticides on ants.

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