Evaluation of Funnel Cone Traps with Different Baits for Capturing Nuisance Arthropods in College Station, Texas

Authors

Anisah Ali, Kenesha Williams, and Clare Zandy

Edited by Emma Manuel

Texas A&M University, Department of Entomology

Abstract: Controlling arthropod pest species has been a primary concern since the beginning of agriculture. The intent of this study was to test the effectiveness of small funnel traps in attracting and killing nuisance arthropods such as various species of flies, ants, and cockroaches in College Station, Texas. A total number of 6 plastic funnel traps were placed across the campus of Texas A&M University, in five different locations. Traps were set for 36 hours between checking and trapping was conducted from March 27 to April 28, 2018. Insects were overall more attracted to the molasses bait most likely due to its high sugar content and sweet smell. Among all the insects collected, the most common were ants were *Brachymyrmex patagonicus* (Mayr) (rover ant) followed by *Solenopsis invicta* (Buren) (red imported fire ant). Among all the nuisance arthropods collected, this was the first report of *Nylanderia fulva* (Mayr) (tawny crazy ant) being present on the campus of Texas A&M University.

Keywords: Nuisance arthropods, bait traps, funnel traps

Insect control has been an area of great interest since the first Agricultural Revolution during the Neolithic era. Since insects were a cause to crop destruction, early farmers used different methods to control the pest population. These methods include plant-derived pesticides and naturally occuring controls. As time went on, different avenues to pesticides were explored, but certain plants derivatives were often used due to their effectiveness (Frazer 1997). These certain plants were able to attract insects and kill them. More modern pesticides were created from the 1930s and beyond. Advances in DDT as a pesticide and IPM as an integrated system allowed farmers to better protect their crops from pest destruction (Daisley et al. 2018).

Since high doses of pesticides in concentrated areas was deemed as detrimental to human health, different techniques had to be developed for insect control. Insect spray has become a must-have for many outdoor activities but can be

hazardous to human health since it contains diluted pesticides. Safer pest control methods were sought to avoid the use of insecticides. Households instead utilize insect traps or bug zappers to kill insects. Currently, new innovations for insect traps are on the rise as more insects evade the already existing traps. This experiment was focused on the FlyStop insect cone funnel trap and different attractive baits in the efficacy of killing pest arthropods (Murguía-González et al. 2017). This is relevant in that if there is an effective way to trap commonplace insects, it would be easier on the everyday household.

Insects have specialized olfactory and visual organs that assist them in food location. Pollen feeders are attracted to sweeter, fruity smells because they can follow the scent to the location of plants that they normally feed on (Cook et al. 2003). Some insects also have simple eyes that only allow the visual input of light and dark surfaces, so a glow in the dark trap will cause attraction. Interesting enough, some insects are less attracted to LED lights than other traditional light sources (Wakefield et al. 2016). This can be indicated to the fact that insects are attracted to UV light, which is not typically found in LED lights.

For the purpose of the experiment, nuisance arthropods were defined to be any arthropod that one may describe as an inconvenience, annoyance or vector of disease. This includes many species of flies, ants, cockroaches, and beetles.

Materials and Methods

The experiment was conducted at different, representative locations across the campus of Texas A&M University. The five locations selected included: Research Park, Bush School gardens and pond, dumpsters, beside the underground food cafe, and the outside of Hobby and Lechner residence halls. In each location, traps were placed on the ground in soil, flower beds, or grass rather than on concrete, in order to increase the likelihood of insect attraction to the trap (Cohnstaedt et al. 2012). The experiment consisted of bottle traps with blue or glow-in-the-dark cones with different baits (Murillo et al. 2018). At each location, six bottle traps were spaced out two feet apart. Three of the traps had blue cones with holes, whereas the other three had glow-in- the-dark cones with holes.

Over the span of the experiment, four different types of baits were tested, with water as a control. At each location, molasses, apple cider vinegar, yeast with brown sugar, and mosquito traps were compared. The main difference between the traps was their emitted scents, with the molasses being sweet, the mosquito traps being bitter, the yeast smelling like bread and rotten food, and the apple cider vinegar smelling bitter and sweet. The molasses, apple cider vinegar, yeast, and water traps were poured separately into a blue and glow cone trap in addition to one drip of dish soap. The mosquito bait trap, however, was a packaged solid placed in water and dish soap in a trap, in order to emit a stronger fragrance. The purpose of dish soap in the experiment was to break the water surface tensions and kill the arthropods by drowning. The traps were left in their designated locations for 36 hours across a span of five weeks from March 27 to April 28 of 2018. Over this time period

the traps were only placed out on warm days and evenings, in order to increase the probability of insect collection.

Results

Of all the arthropods collected, the majority were various species of ants such as *Brachymyrmex patagonicus* (Mayr) (rover ant) and *Solenopsis invicta* (Buren) (red imported fire ant). Surprisingly, *Nylanderia fulva* (Mayr) (tawny crazy ant) was also captured in this survey. In addition to the three species of ants, a few species of beetles, flies and cockroaches were captured. The assorted species include *Periplaneta americana* (L.) (American cockroach), *Drosophila melanogaster* (Meigen) (fruit fly), and members of the order Coleoptera. The most species diversity was seen in more natural areas such as Research Park. On average, the traps placed near urban areas resulted in lower numbers of collected arthropods. The experiment proved the blue cone traps to be more effective in capturing nuisance arthropods than the glow cone traps, as seen in Fig. 1 and 2 below. In addition, the molasses proved to be the most attractive bait for the blue traps, whereas yeast was the most attractive bait for the glow traps.

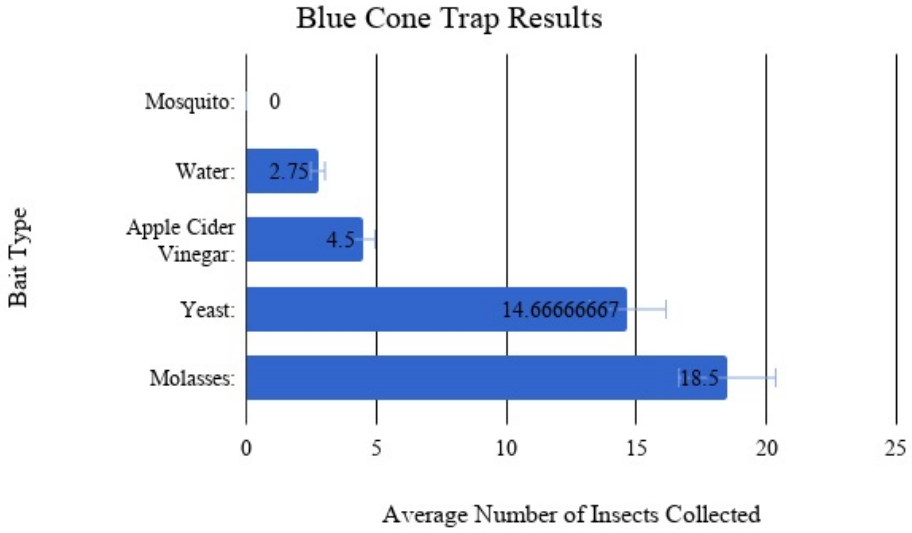

Fig. 1. The average number of insects collected per each blue cone bait trap.

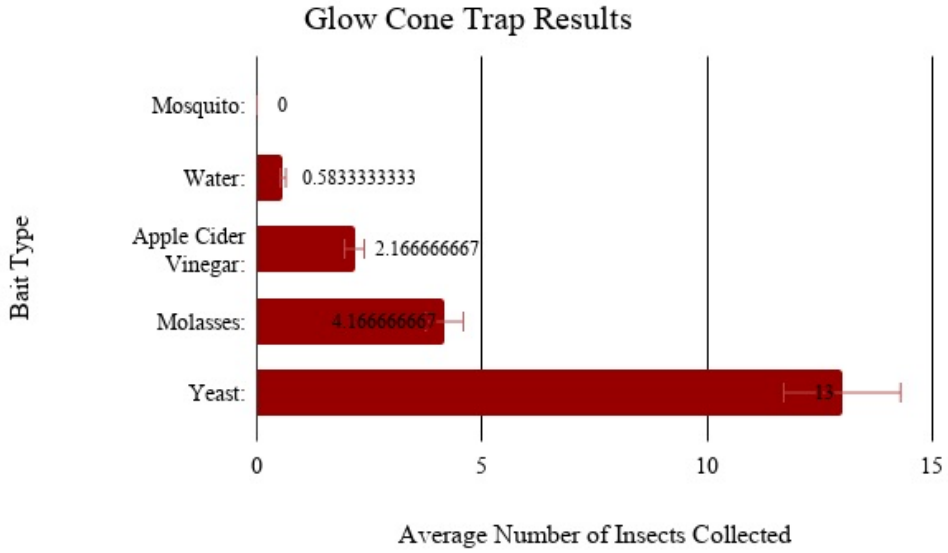

Fig. 2. The average number of insects collected per each glow cone bait trap.

Discussion

Based upon the results, the baits ranked in order of attractiveness to arthropods is as follows: molasses, yeast, apple cider vinegar, water, mosquito, as seen in Fig. 1 and 2. The majority of nuisance arthropods collected pertained to various species of ants. The species of arthropod collected depended not only on the bait, but the location the bait was left. For example, in Research Park, cockroaches were collected in addition to ants in both yeast containers. The largest number of ants collected were in more natural areas such as the Bush School gardens and Research Park. Molasses was the best bait in this study because the different arthropods were attracted to the sweet smell and probably mistaken it for a food source. It's interesting that the yeast was a close second since the smell is completely different from the molasses bait. The smell at first resembled that of baked bread, which later morphed into rotten food. The scent was pungent enough to overwhelm the sensory organs of the insects and caused insect attraction.

Comparing the number of insects collected in Fig. 1 and 2, more insects were attracted to the blue cones than the glow-in-the-dark-cones. This is interesting because we would have expected the light to have attracted more insects. Surprisingly, insects aren't only attracted to light; they're attracted to color that emit different wavelengths (Cohnstaedt et al. 2012). The insects we captured were attracted to the blue cones due to the low wavelength emitted. A possible source of error was that the glow in the dark cones didn't glow for the entire night and couldn't have attracted different insects.

The location of the traps affected which arthropods were collected, depending on their habitat preferences. For example, *Solenopsis invicta* (red imported fire ant), is an invasive species with a wide habitat range

spanning across the southern United States (Neff et al. 2011). Therefore, it was not surprising to find the species at all the locations tested. Similarly, the placement of traps near a natural water source and undeveloped land at Research Park yielded to the attraction of *Periplaneta americana* (American cockroach). The entrapment of fruit flies was also dependent on location. The placement of the traps in garden areas at the residence halls and Bush School increased the likeliness of their attraction to the bait, due to the close similarity between the sugar of flowers and the molasses baits used. Rover ants are found across the Gulf Coast and have more recently been found in Texas (Tamayo 2017). Rover ants are known to inhabit both natural and urban areas, therefore it is logical for them to be found in all the locations tested (Tamayo 2017). The survey had an interesting development in that *Nylanderia fulva* was caught at Bush School and the dumpsters. According to Dr. Robert Puckett, an entomologist researching urban entomology and invasive species ecology, this is the first report of *Nylanderia fulva* being present on the Texas A&M campus (Puckett 2018). According to a study in 2002, the tawny crazy ant was seen near Houston, TX so it's valid for the species to travel up to College Station (Wang et al. 2016).

Originally, the insect traps were designed to trap flying arthropods like flies and mosquitoes, but there were several days where no arthropod were caught. The obstacle in those specific experiments was that the weather was fluctuating, and it could have affected the location of flying arthropods. The collection time for many of the traps took place at night. For example, some traps were placed around 8 PM, which means that the trap was out for 24 "night hours" and 12 "day hours." If the traps were out during more "day hours," it could have increased our chances of capturing more arthropods. Mosquitoes weren't caught during the duration of this experiments, which can also be indicative of the cooler days. Although mosquitoes were active during this study, the cool nights might have limited their interest in the baits and thus a trial later in the year might be better for targeting mosquitoes.

Even though the conditions weren't ideal, the results show promise in the baits and trap styles. The materials used can trap land-dwelling arthropods. For future trials, the traps should be deployed during different seasons and weather conditions as well as trying different locations such as residential areas.

Acknowledgments

We would like to thank Dr. Gabriel Hammer for providing us with the materials for the insect traps and giving us guidance on this experimental survey. We would also like to thank Dr. Robert Puckett for his help in identifying the multiple ant species we captured. Lastly, but not least, we thank McFly for providing the traps and baits used in this study.

References

Cohnstaedt, L. W., K. Rochon, A. J. Duehl, et al. **2012.** Arthropod Surveillance Programs: Basic Components, Strategies, and Analysis. Annals of the Entomological Society of America. 105:135-149.

Cook, S. M., E. Bartlet, D. A. Murray, & I. Williams. H. 2003. The role of pollen odour in the attraction of pollen beetles to oilseed rape flowers. Entomologia Experimentalis et Applicata, 104: 43-50.

Daisley, B. A., Trinder, M., Mcdowell, T. W., Collins, S. L., Sumarah, M. W., & Reid, G. 2018. Microbiota-Mediated Modulation of Organophosphate Insecticide Toxicity by Species-Dependent Interactions with Lactobacilli in a Drosophila melanogaster Insect Model. Applied and Environmental Microbiology, 84.

Frazier, M. 1997. A Short History of Pest Management. Pennsylvania State University.

Lebrun, E. G., K. J. Ottens, & L. E. Gilbert.2017. The microsporidian pathogen Myrmecomorba nylanderiae: Intracolony transmission and impact upon tawny crazy ant (Nylanderia fulva) colonies. J. App. Ento., 142: 114-124.

Murguía-González, J., I. Landero-Torres, O. R. Leyva-Ovalle, M. E. Galindo-Tovar, R. C. Llarena-Hernández, E. Presa-Parra, & M. A. García-Martínez. 2017. Efficacy and Cost of Trap–Bait Combinations for Capturing Rhynchophorus palmarum L. (Coleoptera: Curculionidae) in Ornamental Palm Polycultures. Neotropical Entomology, 47: 302-310.

Murillo, A. C., D. Cox, & B. A. Mullens. 2018. Longevity of Fly Baits Exposed to Field Conditions. J. Economic Entomology, 111: 967-973.

Neff, R., R. T. Puckett, & R. E. Gold. 2011. Particle Size and Bait Preference of Red Imported Fire Ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae). Sociobiology 58: 1-15

Puckett, R. 2018. Entomology Research Project. Message to author.

Tamayo, D. 2017. Brachymyrmex patagonicus Mayr. *University of Florida.*

Wakefield, A., M. Broyles, E. L. Stone, G. Jones, & S. Harris. 2016. Experimentally comparing the attractiveness of domestic lights to insects: Do LEDs attract fewer insects than conventional light types? Ecology and Evolution, 6: 8028–8036.

Wang, Z., L. Moshman, E. Kraus, B. Wilson, N. Acharya, & R. Diaz. 2016. A Review of the Tawny Crazy Ant, Nylanderia fulva, an Emergent Ant Invader in the Southern United States: Is Biological Control a Feasible Management Option? Insects, *7*: 77.