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Use of essential oils as a pest deterrent against the common house cricket (*Acheta domestics*)

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ABSTRACT

Essential oils have been shown to be a safe repellent against numerous insects. Peppermint, citrus, tea tree and eucalyptus oils were tested as a deterrent against the common house cricket. Crickets entered a T-tube with a control at one end and a test oil at the other. A T-test was used to determine any significance from the control in the cricket choices of exit from the tube. The results were that eucalyptus and tea tree had an effect on the crickets with a proportion of 0.632 for eucalyptus and tea tree was 0.313. Citrus and peppermint oils did not show a significant difference like eucalyptus and tea tree oils.

Keywords: *peppermint oil, eucalyptus oil, tea tree oils, citrus oil*

INTRODUCTION

Pest control has long been an issue in home and farm environments. Many chemicals used as insect repellents are toxic not only to the insects but to the humans living in the environment. An example is DEET (N,N-Diethyl-meta-toluamide) is a very effective bug deterrent, but toxic in large doses to humans(CITATION). Another common chemical class is the pyrethroids which can become toxic to the central nervous system(Timothy 2005). Alternatives to these toxic chemicals have included diatomaceous earth, and essential oils. Essential oils are concentrated non-polar extractions that contribute to the scent of a plant. These oils have been shown to be safe in human dwellings. The use of essential oils as a green pest deterrent will provide a better and safer environment for humans and animals (Koul, Walia & Dhaliwal, 2008). In farming, Saroukolai et. *al*. (2014) showed how essential oils were toxic to the Colorado Potato Beetle. How long these oils remain effective against specific insects is an area of current research.

A field and lab test in Australia showed that essential oils in alcohol-based spray were effective against mosquitos (Greive et. Al., 2010). Tea tree oil and some local plant extractions (including eucalyptus oil) were tested against DEET (Greive et. *al*., 2010). The stronger the essential oil applied in a longer time frame, the more effective against deterring mosquitos. Soutar, Cohen and Well (2019) compared DEET against thyme and oregano oils in tick deterrence. The thyme oil showed a 70% effectiveness while DEET was only at 64%.

Strong essential oils can disrupt the neurosensory connections in insects. This concept of sensory disruption was also tested against the American and German cockroaches with mint oils (Appel et. *al*., 2001). Toxicity was determined using topical application and continuous exposure methods. In a comparison of essential oils of Chinese medicinal herbs (Liu et. *al*., 2011), they noticed that the cockroaches will avoid strong essential oils within a short time frame, but will return to the area after 2-3 hours. The household cricket (Gryllidae sp.) has some similar physiology to the cockroach and lives in human occupied spaces. The project will assess how variety of essential oils; Tea Tree, Eucalyptus, Peppermint, and Citrus oils repel the common household cricket (gryllidae) in comparison of water control. These oils were chosen based on their documented effectiveness in pervious cited experiments.

MATERIALS AND METHODS

The essential oils that were being used to conduct this experiment are peppermint, citrus, tea tree, eucalyptus and water control.

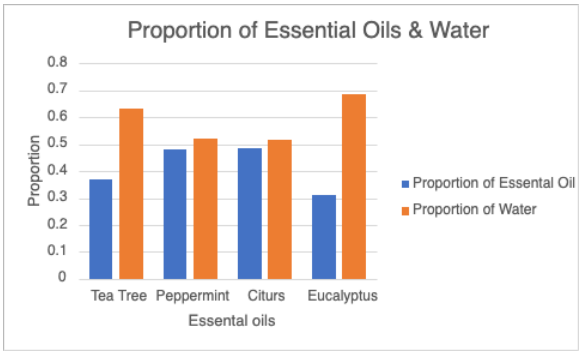
The experiment is seeing if the cricket will avoid down the tube with the essential oils at the end of it. To be able to do this experiment well, four crickets at a time will go into the tube so they can acclimate and get a sense of direction. When the essential oil is added to one of the ends of the tube, they can either avoid that side or go toward the water. This experiment is also a behavior study because we are observing to see how the crickets respond to the essential oils.

A 2 ¼ inches diameter PVC pipe 13 inches long was connected to a 6 inches entry pipe making a T-tube design. A battery powered fan was placed at the entry of each tube. Crickets were introduced at a time in the entry tube to acclimated before the treatments were added. A filter paper disc was treated with the oil to be tested at one end and a control of water on the other. Crickets could exit the treatment end or the control end of the T-tube. Numbers were counted and recovered as the crickets exited the tube. A waiting period of 15 minutes occurred between the different treatments.

Making sure that the temperature is between 80-85 degrees Fahrenheit, lights were dimed, so the crickets stay calm. Keeping the crickets as calm to get good results.

RESULTS

The results from the experiment is that it it's a fifty-fifth chance wither the cricket will choose to go down the tube that had the essential oil or the tube that had water. According to Figure 1, you can see that in tea tree oil and eucalyptus had a higher deterrent than the control. The proportion of crickets choosing water was 0.632. For eucalyptus oil it was similar to tea tree oil proportion but was higher in water 0.688 and 0.313 for the essential oil. Eucalyptus oil showed a significant difference from the control with a p value <0.004 while Tea tree oil was <0.038. Both of these oils showed moderate deterrence for crickets. Peppermint and citrus oils were similar in values and not significantly different with the control with p values at 0.813 and 0.904 respectively



DISCUSSION

Choosing to use crickets for the experiment was an easy way to get results, because they have similar nervine systems as cockroaches and other insects. By counting the number of crickets that come out of the ends of the tubes that either have the essential oil or water. It was important that keeping the crickets in a good and stable environment to be able to compare results of each trial.

Out of the four essential oils that were tested only Eucalyptus and Tea tree oils had significant p values over the control.

In the article that talks about the Colorado potato beetle they saw with their results that the oils they were using had some effect on the beetle. In that article they were looking to find an alternative way to keep insects away in agriculture and seeing if essential oils work better than using pesticides. Another article was seeing how to keep mosquitoes away from biting the subjects in their experiment. The scantiest used different ways to apply the essential oils like an alcohol-base spray, emulsion and a gel to see which worked better to keep the mosquitoes from biting the subjects.

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