



EFFECTS OF DIFFERENT ORGANIC INSECTICIDES ON THE MORTALITY OF COCKROACHES

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ABSTRACT

Organic insecticides are a non-chemical approach for pest management. They are composed of organic ingredients that are environment friendly and inexpensive. Organic insecticides are now widely used to control pests in the household level. One of the ongoing problem in the household that needs to be dealt with is cockroach infestation. To control this ongoing problem, the researchers conducted a study to determine the effects of different organic insecticides namely: chili fruit extract (*Capsicum annum*), garlic extract (*Allium sativum*), onion extract (*Allium cepa*), and tobacco extract (*Nicotiana*) on the mortality rate of American cockroaches (*Periplaneta americana*). The cockroaches were exposed to the organic insecticides for one hour. Analysis of Variance (ANOVA) for one-way classification was used to find out if there is a significant difference on the effects of the different organic insecticides on the mortality rate of cockroaches. The Duncan's Multiple Range Test (DMRT) was administered after solving the ANOVA to determine the significant differences of the insecticides from each other. The findings obtained in the study were the following: (1) the garlic extract obtained the highest average mortality rate of 4.33 followed by tobacco extract with an average mortality rate of 3.33, chili extract with 1.67 and onion extract with 0 average mortality rate; (2) the effects of the different organic insecticides on the mortality rate of the cockroaches are significantly different from each other; and (3) having obtained the highest average mortality rate of cockroach, garlic extract is the most effective to kill cockroaches among the three organic insecticides.

Keywords: chili, cockroaches, garlic, organic insecticides, onion, tobacco

I. INTRODUCTION

As human population continues to rise, pests goes along with these overwhelming trend. Pests live in close association with people to address their needs like foods. One notable pests in the household are cockroaches. As pests, cockroaches eat a great variety of food, including all food used for human consumption. Further, they play a role as carriers of intestinal diseases, such as diarrhea, dysentery, typhoid fever and cholera because of their filthy habits and bad smell [World Health Organization (WHO), 1997].

Cockroaches may not usually be the most important cause of a disease, but they may play a supplementary role in the proliferation of some diseases (WHO, 1997). Due to the threats being posed by these creatures, control measures should be done. Heavy infestations of cockroaches can be dealt with by chemical control measures, followed by environmental management to deprive the pests of food and shelter (WHO, 1997). However, controlling cockroaches at home or on other areas and buildings does not only mean using toxic

chemical sprays that pose hazards to children or pets but it could also be made from organic ingredients.

Insecticides are substances used to kill insects or pests. It could be organic and inorganic. Chemical insecticides are commonly used nowadays but there are many harmful effects in using these chemicals. Among those are threats they pose in the surroundings like pollution (Yvonie, 2009). On the other hand, organic insecticides are safer and eco-friendly that helps in reducing artificial interference. The organic insecticides mitigate cost of health management because it reduces inhalation of toxic fumes of synthetic chemicals.

According to Yvonie (2009), natural insecticides use botanical or organic materials in controlling insects. Some plants produce a distinctive chemical or odor that can drive away insects or pests. Since many of these plants are commonly growing in the backyards, they are inexpensive and environment friendly. Chili fruit (*Capsicum*

annuum), garlic (*Allium sativum*), onion (*Allium cepa*), and tobacco (*Nicotiana*) are some examples of plants that produce a distinctive chemical or odor that could be an active ingredient for insecticides. Chili fruit (*Capsicum annum*) is a plant which causes irritation or burns. When insects ingest its extract, the chili burns their bodies and causes them pain. Garlic (*Allium sativum*) on the other hand, is a plant that contains a chemical called allicin, which is responsible for their strong pungency and aroma and lectins or lectin like compounds that may interfere with different aspects of the insect life cycle. These garlic compounds are toxic to many insects or pests and can be a strong deterrent to feeding and egg laying behavior. In addition, onion (*Allium cepa*) contains sulfur compounds that can keep insects away by simply producing an odor while tobacco (*Nicotiana*) has nicotine, a key toxin in tobacco, with known insecticidal properties on its own. The active components include a mixture of phenols with known pesticidal properties working synergistically (Potera, 2011).

Thereby, this study focuses on the effects of the different organic insecticides namely: chili fruit extract (*Capsicum annum*), garlic extract (*Allium sativum*), onion extract (*Allium cepa*), and tobacco extract (*Nicotiana*) on the mortality of the cockroaches. The result of this study will help home and business owners deal with cockroach infestations in an environmental friendly way and cheaper monetary cost.

II. MATERIALS AND METHODS

The study was conducted at Mindanao State University – Buug Campus specifically in the STEAM 12- Integrity classroom of the Senior High School Building on April 2019.

The chili fruit, garlic, onion, and tobacco were purchased in the market of Buug, Zamboanga Sibugay. Each of the items were blended except for the tobacco in which it was boiled. Using fine filter cloth, each of the purchased items were filtered and squeezed to get 5 ml concentrated extract. Furthermore, 60 cockroaches were taken at the Public Market in Buug, Zamboanga Sibugay where cockroach infestations are known. Only one cockroach species was tested, the American cockroach. The cockroaches were reared for 2 days before it was subjected for experimentation. The cockroaches were provided with 50 ml water in a wide cup and 100 grams of Purina rat chow. The cockroaches were placed in a big wooden container with its sides made from mosquito net's cut-outs. The container filled with 60 cockroaches were placed in the house of one of the researchers.

After two days, the cockroaches were tested on the insecticides. The glass containers with proper aeration being used were labelled as T₁, T₂, T₃, and T₄. The four treatments were replicated three times. The following treatments were used in the study:

- T₁ – was applied by 5 ml of concentrated chili fruit extract
- T₂ – was applied by 5 ml of concentrated garlic extract
- T₃ – was applied by 5 ml of concentrated onion extract
- T₄ – was applied by 5 ml of concentrated tobacco extract

Four different insecticide tests were performed during the experiment. The extracts of the insecticides were evenly distributed in each respective glass jar. After adding the insecticide in the glass jar, the

glass jar was rolled on a flat surface to uniform the distribution of insecticide inside the glass jar to achieve better results. The effects of the different organic insecticides were evaluated by adding 5 cockroaches with sizes ranging from 1.5-2.5 inches per glass jar. The duration of the experiment was based on a 1-hour scale. Cockroaches' mortality was recorded after a 10-minute interval for 60 minutes.

To analyze the data, the Analysis of Variance (ANOVA) for one-way classification was used to find out if there is a significant difference on the effects of the different organic insecticides on the mortality rate of cockroaches. The Duncan's Multiple Range Test (DMRT) was administered after solving the ANOVA to determine the significant difference of the insecticides from each other.

III. RESULTS AND DISCUSSIONS

TABLE 1

Mortality Rate of Cockroaches to the Different Treatments for 1 hour

Replication	T ₁ Chili	T ₂ Garlic	T ₃ Onion	T ₄ Tobacco
R ₁	2	4	0	3
R ₂	2	5	0	3
R ₃	1	4	0	4
Total	5	13	0	10
Average	1.67	4.33	0	3.33

Table 1 shows the average mortality rate of cockroaches to the different treatments. As presented, T₂ (Garlic) obtained the highest average mortality rate of 4.33 followed by T₄ (Tobacco) with 3.33, T₁ (Chili) with 1.67 and T₃ (Onion) with 0 average mortality rate.

The Analysis of Variance (ANOVA) revealed that the computed "f" (43.556) is greater than the tabulated "f" at both 5% (4.07) and 1% (7.59) levels of significance. This gives sufficient statistical evidence that the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, there is a significant difference on the effects of the different organic insecticides on the mortality rate of cockroaches.

TABLE 2
Duncan's Multiple Range Test

Treatments	Means	Difference	Significance
T ₂ Garlic	4.33		a
T ₄ Tobacco	3.33	1.0	b
T ₁ Chili	1.67	1.66	c
T ₃ Onion	0	1.67	d

Post hoc comparisons using Duncan's Multiple Range test shows which among the four organic insecticide are significantly different

from the other. Only T₂ (garlic) significantly differs from all the other organic insecticide with the highest mean value of 4.33. Therefore, the result concluded that T₂ (garlic) is significantly much potent to cockroach compared to the other three organic insecticides. The rest of the organic insecticides were significantly equal in terms of potency to cockroaches.

In this study, it was found out that garlic extract killed the most number of cockroaches followed by tobacco and chili extract. Garlic extract killed 13 out of 15 or 86.57% of the cockroaches in a one-hour time frame. According to Asianparent (2018), Irina (2019) and Srikanth (2018), garlic is immensely effective against cockroaches. It has essential oils, diallyl disulfide and diallyl sulfide which induced symptoms of intoxication and necrosis to cockroaches (Parker, 2002). Moreover, garlic has been used in the intercropping systems because of its ability to repel insects (Debra & Misheck, 2014). It produces excretions from its roots as well as aromas from their leaves. These excretions and aromas discourage insects, and are therefore regarded as insect repellent.

Tobacco extract is second, next to garlic extract of having the most number of cockroaches kill. It killed 10 out of 15 or 66.7% of the cockroaches in a one-hour time frame. For centuries, tobacco was used as natural organic pesticide due to tobacco's content of toxic nicotine (American Chemistry Society, 2010). Nicotine is a poisonous, colorless, oily, liquid, plant alkaloid with a very acid taste (Soria, 2009). It is addictive and a central nervous system (CNS) stimulant that causes either ganglionic stimulation in low doses or ganglionic blockage in high doses. Nicotine acts as an agonist at the nicotinic cholinergic receptors in the autonomic ganglia, at neuromuscular junctions, and in the adrenal medulla and the brain (Soria, 2009). With this, Febriyanti (2013), concluded that nicotine has a promising potential as an environmentally benign insecticide. Lastly, Soria, (2009) concluded that the dried tobacco plant can be a good pesticide against cockroaches.

Chili extract comes third which killed 5 out of 15 or 33.3% of the cockroaches in a one-hour time frame. Fushiknights (2009) conducted an experiment and concluded that chili fruit is feasible in making pesticide. Moreover, Yvonie (2009), concluded that chili extract can kill insects in 30 minutes.

In this study, onion extract did not kill any of the cockroaches. But, some researchers claimed that onion is a good insect repellent. In fact, onions have been used in the intercropping systems because of its ability to repel insects (Debra & Misheck, 2014).

IV. CONCLUSION

Based on the findings of the study, the researchers concluded the following:

1. Garlic extract obtained the highest average mortality rate of 4.33 followed by tobacco extract with an average mortality rate of 3.33, chili extract with 1.67 and onion extract with 0 mortality rate.

2. There is a significant difference on the effect of the different organic insecticides on the mortality of cockroaches.
3. Garlic extract is the most effective organic insecticide in terms on the mortality of cockroaches among the four organic insecticides.

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