

The Effect of Garlic, Black Pepper, and Clove As Natural Insecticide Toward Ants

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Abstract: Synthetic insecticide are proven to be very effective in killing ants instantly, however they have been arguably toxic to human due to accumulation of residue caused by constant usage and exposure to consumers. In this study, garlic (*Allium sativum*), black pepper (*Piper nigrum*), and clove (*Syzygium aromaticum*) were experimented on ants for their effectiveness in killing them as natural insecticide. The experiment started with the preparation of aqueous solution of garlic powder, black pepper powder and clove powder, namely solution A, B and C. All these three pure solution were then mixed to form mixture of two solution; mixture of A and B, mixture of A and C, mixture of B and C and mixture of three solution; mixture of A, B and C. Each solution was filled into spray bottle and tested in three trials with each trial containing approximately ten ants in a petri dish. The time allotted for each trial are 30 minutes with five minutes time interval. The result indicated that commercial synthetic insecticide kill all ants upon immediate contact while natural insecticide tended to kill ants over longer period of time which about five to ten minutes. Based on the findings, the mixture of all solution A, B and C which is clove, black pepper, and garlic solution are comparable to synthetic insecticide used with less detrimental effect from prolonged and continuous usage and provide better alternatives to synthetic insecticide commonly used by consumers in Malaysia.

Keywords: Ants, Synthetic insecticide, Natural insecticide

1. Introduction

Ants have been exploiting urban, agricultural, and natural habitats all around the world since a long time ago. With rapid urbanization and increasing human activities, invading ant species can disrupt ecosystem balance and causing economic loss [1]. Generally, ants can be characterized by the constriction between the abdomen and thorax, six legs, a large heads with compound eyes, elbowed antennae, and powerful jaws. Their bodies are covered with exoskeleton, most having colour of either red or black. Since ants reproduce with little to no natural predators, concern for their increased presence are growing among people. Some species may sting and bite which particularly a major issue for

individuals that have no movement abilities, especially infants and the elderly [2]. There is also a rare cases of human population that severely allergic to certain ant stings and finally resulting in shock or even death.

To control ants presence many consumer would usually choose conventional insecticide that contain synthetic chemicals. Uncontrolled use of this type of insecticide causes contamination of the environment while increasing the number of nesting ants species due to colonies fragmentation [3]. One particular chemical that contain in most synthetic insecticide is Prallethrin. This compound is the most effective and widely used in synthetic insecticide solution. However, Prallethrin has detrimental effects apart from its benefits [4]. There has been some studies and cases where people that have been continuously exposed to Prallethrin developed symptoms such as skin and eye irritation, cough, chest pain, nausea, vomiting, even seizures and coma in some cases indicating Prallethrin poisoning [5]. Therefore, as a substitute to Prallethrin, spices and herbs commonly used in household are considered as safer or natural alternative compare to synthetic insecticide [6]. Since then, research efforts for natural and eco-friendly insecticide are also on the rise. Some natural-based insecticide are known to be comparable or even better to synthetic insecticide [7]. Therefore, this study was carried out to find out the effectiveness of garlic, black pepper, and clove powder in the form of aerosol liquid as insecticide to kill ants.

2. Materials and Methods

2.1 Materials

Garlic (*Allium sativum*), black pepper (*Piper nigrum*), and clove (*Syzygium aromaticum*) powder were obtained from online market with each packet containing 100 gram powder. All three powder were filtered with 200 Micron strainer to eliminate clumps. 20 gram of each powder was weighed separately. Weighed powders were then soaked in 400 millilitre of distilled water at 60 °C. The solutions were then filtered using muslin cloth to remove any presence of large residue. All three aqueous solution were then kept soaked at room temperature overnight in chemical bottles. After a day the solution was stored in chiller at 10 °C. All the solution were labelled as solution A, B and C, and each solution was tested on the same day for each test set. Lists using items marked with a,b,c, or i, ii, iii, and so on can also be considered. Items in the list should be indented similar to paragraph indentation.

2.2 Methods

Aqueous garlic solution, aqueous black pepper solution, and aqueous clove solution were mixed together to form a mixture of two aqueous solution; aqueous garlic solution with aqueous black pepper solution, aqueous garlic solution with aqueous clove solution, and aqueous black pepper solution with aqueous clove solution. All three solutions were also mixed into one solution. All of the solution were heated to room temperature (25°C) and homogenized. The solutions were then measured at 100 millilitre using graduated cylinder per each mixture constituents.

Twenty seven petri dish were placed on laboratory bench. Ants that have been caught on the same day were placed in chiller for two minutes to reduce their physical movement. They were then picked up gently using tweezers and transferred into petri dish. Each petri dish contained ten ants. They were then sprayed with aerosol aqueous solution for two times at the distance of approximately 25 centimeter. Each set was then left and periodically checked for every five minutes consecutively until half an hour to count the number of alive and dead ants. Three set of testing were done for every aqueous solution. Control test was also done by using Ridsect Advance containing Prallethrin with the same method as the treatment above. All petri dish testing set were sprayed with ethanol to preserve the dead ants.

3. Results and Discussion

3.1 Results

In this study, garlic, black pepper, and clove were tested for their effectiveness as natural insecticide with different type of solution and constant concentration toward ants. Each time interval was recorded for the number of ants that have died for each test. The obtained results were tabulated in Table 1.

Table 1: Number of ants killed during each time interval for Test 1, Test 2 and Test 3

| Solution | No. of ant killed per time interval (minutes) | | | | | | | | | | | | | | | | | |
|-----------------|---|----|----|----|----|----|--------|----|----|----|----|----|--------|----|----|----|----|----|
| | Test 1 | | | | | | Test 2 | | | | | | Test 3 | | | | | |
| | 5 | 10 | 15 | 20 | 25 | 30 | 5 | 10 | 15 | 20 | 25 | 30 | 5 | 10 | 15 | 20 | 25 | 30 |
| A | 0 | 0 | 3 | 7 | 0 | 0 | 0 | 0 | 4 | 6 | 0 | 0 | 0 | 0 | 1 | 9 | 0 | 0 |
| B | 0 | 4 | 6 | 0 | 0 | 0 | 0 | 2 | 8 | 0 | 0 | 0 | 0 | 3 | 7 | 0 | 0 | 0 |
| C | 6 | 4 | 0 | 0 | 0 | 0 | 5 | 5 | 0 | 0 | 0 | 0 | 2 | 8 | 0 | 0 | 0 | 0 |
| A & B | 0 | 7 | 3 | 0 | 0 | 0 | 0 | 5 | 5 | 0 | 0 | 0 | 0 | 9 | 1 | 0 | 0 | 0 |
| A & C | 7 | 3 | 0 | 0 | 0 | 0 | 6 | 4 | 0 | 0 | 0 | 0 | 7 | 3 | 0 | 0 | 0 | 0 |
| B & C | 8 | 2 | 0 | 0 | 0 | 0 | 8 | 2 | 0 | 0 | 0 | 0 | 9 | 1 | 0 | 0 | 0 | 0 |
| A, B & C | 10 | 0 | 0 | 0 | 0 | 0 | 9 | 1 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 |
| Ridsect Advance | 10 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 |
| Untreated | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

In Table 2, the average number of ants killed per time interval for each three test was shown. Solution A: Garlic, B: Black paper and C:Clove

Table 2: Average number of ants killed from all three test respective to each time interval

| Solution | Average number of ants killed per time interval (minutes) | | | | | |
|-----------------|---|------|------|------|----|----|
| | 5 | 10 | 15 | 20 | 25 | 30 |
| A | 0 | 0 | 2.67 | 7.33 | 0 | 0 |
| B | 0 | 3 | 7 | 0 | 0 | 0 |
| C | 4.33 | 5.67 | 0 | 0 | 0 | 0 |
| A & B | 0 | 7 | 3 | 0 | 0 | 0 |
| A & C | 6.67 | 3.33 | 0 | 0 | 0 | 0 |
| B & C | 8.33 | 1.67 | 0 | 0 | 0 | 0 |
| A, B & C | 9.67 | 0.33 | 0 | 0 | 0 | 0 |
| Ridsect Advance | 10 | 0 | 0 | 0 | 0 | 0 |
| Untreated | 0 | 0 | 0 | 0 | 0 | 0 |

The graph of average number of ants killed per time interval from all three test was illustrated in Figure 1 .

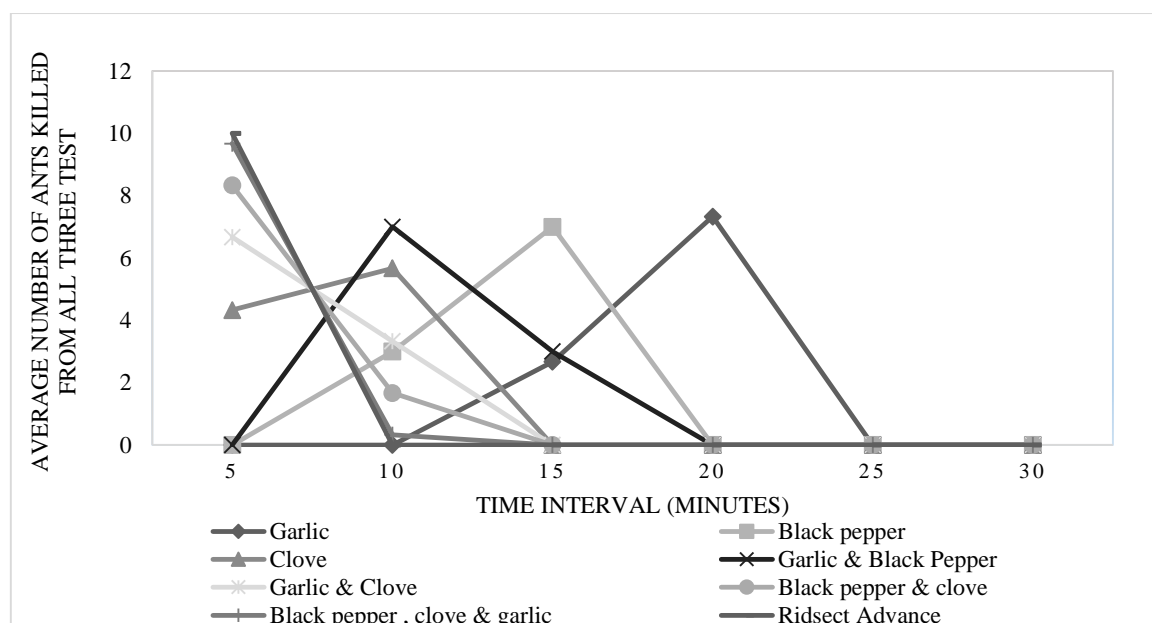


Figure 1: Graph of average number of ants killed per time interval from all three test respective to each time interval

From the result of the testing, all three aqueous solutions showed that almost all solutions require of more than five minutes to kill all ants except for clove and mixture of clove solution. Pure clove and mixture of clove solutions for all three testing took of only five minutes to kill high number of ants. Black pepper and mixture of black pepper solution took on average of ten to fifteen minutes to kill all ants. Garlic solution with mixture of garlic solution took the longest time to kill ants on average of fifteen to twenty minutes for every testing. For the control solution that is by using synthetic insecticide (Ridsect Advance) ants were killed almost instantly upon contact. Untreated ants for all three testing survive for more than thirty minutes.

3.2 Discussions

The results show that black pepper, clove, and garlic solution with synthetic compound, Prallethrin in commercial grade products to be effective at killing ants in a timely matter. However, in terms of the fastest time taken to kill the most ants for natural insecticides, clove and mixture of clove solutions are the most effective are In regards to availability, both natural and synthetic type of insecticide are easily accessible for the public. Since essential oils derived from natural spices are not economical and easy to use for general consumers this experiment will only focusing on aqueous solution of the spices. From data of the experiment, aqueous mixture of black pepper, clove, and garlic shown to be an effective killer over the course of the experiment. However, practical application is limited as the solution evaporates quickly and leaves limited residue.

Furthermore, each of the spices used can be bought in a relatively large amount (i.e. three hundred gram per bottle or plastic packaging) for approximately RM 10 in most general store. Studies in lower income countries have shown the cost of a 7-month natural insecticide spray can cost as little as RM 0.10 per day per person [8]. Clearly the economics of natural insecticide are viable.

Piperine, allicin, and eugenol an active ingredient in black pepper, garlic, and clove respectively, are not fully understood in terms of insects killing mechanism. Presumably, these ingredients interferes with various enzymatic activities and causes detrimental effect to neurophysiology of exposed insect that ultimately kill them [9]. Future studies could search for various properties, including piperine, allicin, and eugenol killing mechanism, effective lethal concentrations, and other similar attributes.

4. Conclusion

From this study, it can be concluded that garlic, black pepper, and clove have the similarities in effectiveness to kill ants. However, there was a significant difference in effectiveness to kill ants the fastest for all solution and its mixture. The effectiveness for solution garlic and its mixture are the lowest compared to mixture of clove, garlic, and black pepper. Therefore, mixture of clove, black pepper, and garlic can be considered the most effective solution to kill ants the fastest than the rest of the solution tested. This mixture are comparable to synthetic insecticide used with average time taken to kill ants are almost the same with lesser detrimental effect. For a long term solution to insect control, this solution are the most suitable to use for major consumers around Malaysia as the solution's constituents are considered safe for human health and the environment. Thus, natural insecticide present a logical answer to insect control problem as the economic benefit from cheap market price of powder used and reduce the cost of consumer have to bear when purchasing synthetic insecticide.

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