

**THE EFFECT OF APPLICATION OF BORAX DOSAGE
VARIATIONS
ON BAITING GEL ON IMAGO MORTALITY *Periplaneta americana*
YEAR 2021**

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**Abstra
ct**

*Cockroaches are a mechanical vector for several pathogenic microorganisms. The use of chemicals for cockroach vector control has been widely used. Fumigation and spraying have negative effects on human health and environmental pollution. Therefore it is necessary to do another alternative, one way that can be done is by using the Baiting Gel method as a cockroach control. According to Potter & Entomologist (2015) unlike many insecticides, borax does not have insect repellent properties so cockroaches are not deterred from baiting and return to the baiting area repeatedly until they die. This study aimed to analyze the effect of application of various doses of borax on Baiting Gel on the mortality of *Periplaneta americana* imago. This research method is a quasi-experimental design with a non-equivalent control group design. The results showed that a dose of 0 grams of borax had 0% killing power, a dose of 10 grams of borax had 10% killing power, a dose of 15 grams of borax had 30% killing power and a dose of 30 grams of borax had 25% killing power. So from these results, no effective dose of borax was found to kill *Periplaneta americana*. The results of Kruskal Wallis' analysis obtained a significant number with p value = $0.127 > 0.05$, so that there was no effect of application of variations in the dose of borax in Baiting Gel on the mortality of *Periplaneta americana* imago. The conclusion of the study was that there was no effect of the application of variations in the dose of borax on Baiting Gel on the mortality of *Periplaneta americana* imago. It is hoped that other researchers can conduct further research using a combination of active ingredients Borax and Sulfur where previous studies have obtained significant and effective results in killing *Periplaneta americana* cockroaches.*

Keywords: *Periplaneta americana, cockroach, Baiting Gel, mortality, Borax.*

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A. Preliminary

Cockroaches are very close to humans, like buildings that are warm, humid and there is plenty of food, live in groups, can fly, are active at night such as in the kitchen, in food storage, garbage, dirty water channels, generally avoid light, day hides in dark places and often hides reproach. (Meliala, 2017).

Cockroaches can act as mechanical vectors for several microorganisms, such as *Streptococcus*, *Salmonella sp*, *Shigella sp*, *Campylobacter sp*, *Pseudomonas aeruginosa*, *Mycobacterium leprae*, and *Klebsiella pneumoniae* so that they play a role in the spread of dysentery, diarrhea, cholera, Hepatitis A virus, polio in children -children, and as intermediate hosts for several species of worms (Depkes RI, 2014).

Periplaneta americana is one of the easiest species to find in Indonesia because it is one of the largest cockroach species in Indonesia, especially if the area has a temperature and humidity that supports the life and breeding of cockroaches (Cornwell PB, 1968). These cockroaches generally live in wet and humid places and like dirty places, the appropriate temperature is around 26°C, with 80-90% humidity. (Barbara, 2014).

Control of vectors and animals carrying disease is all activities or actions aimed at reducing the population of vectors and animals carrying disease as low as possible so that their presence is no longer a risk for disease transmission in an area. (Permenkes RI No 50, 2017).

The use of synthetic insecticides can have a negative impact on humans, the environment, and other organisms. For humans as users it can cause acute poisoning, for the environment it can pollute water, air and soil.

Control with the *Baiting Gel* method is considered a safer method for the environment and humans because control with this bait will only affect the target animal through the oral route. (Potter & Entomologist, n.d.). *Baiting Gel* is a combination of several chemical compounds that are used to lure cockroaches to come and eat the bait and in the end, the cockroaches will die from eating the insecticide poison contained in it. (Arifah et al., 2016).

The formulation of *Baiting Gel* ingredients can be identified with the food favored by cockroaches as an attraction for *Periplaneta americana* cockroaches. As explained in Salbiah's research (2006) shows that American cockroaches prefer foods that contain high protein and have a more pungent odor such as peanut butter, so foods that are degraded and have high protein are favored by cockroaches.

How it works poison bait (*Baiting Gel*) is included in the stomach poison. This stomach poison enters and works after being swallowed with food into the insect's stomach. The active ingredients of *Baiting Gel* that are widely used in the field are fipronil, hydramethylnon, abamectin, and imidacloprid. If the

insecticide level is too high (in *Baiting Gel*) the cockroaches will resist instead of being attracted. Poisonous baits that are widely used today, do not kill cockroaches too quickly. The greater the percentage of bait consumption, greater and faster mortality can be expected in pest population control.

Borax can make the texture of food chewier so that adult cockroaches like food with a mixture of borax (Junianto, 2013). Adult cockroaches already have strong mandibles, so adult cockroaches like food that is chewy and dense in texture. The results of Gani Bakhtiar's research (2020) showed that based on 9 trials on *Periplaneta americana* imago with the application of treatment doses (borax: 10 grams + sulfur: 3 grams) there was a mortality of 75% of the *Periplaneta americana* population as experimental animals. (Rifai, 2020).

As described above, the authors are interested in conducting experimental research on the application of the *Baiting Gel* formulation with the application of an active ingredient formulation that is different from previous studies, namely the application of the active ingredient borax alone without a mixture of sulfur. Thus, the researchers hope to obtain a causal relationship between the application of *Baiting Gel* with a single dose on the mortality of *Periplaneta americana* cockroach imago.

B. Materials dan Methods

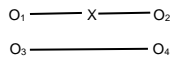
The type of research conducted is quasi-experimental research (quasi-experimental) with a non-equivalent control group design, namely an experimental activity that aims to determine a symptom or effect that arises as a result of certain treatments.

The object of this research is *Periplaneta americana* which was taken from a resident's house. Experiments with treatment dose A (Dose of Borax 0 grams) as a control, treatment B (Dose of Borax 10 grams), treatment C (Dose of Borax 15 grams), and treatment D (Dose of Borax 30 grams). With each sample containing 5 cockroaches. The treatment of each sample was repeated 4 times, so that the total sample required was 80 cockroaches. The number of replications in the experiment was calculated using the Federer formula, as follows:

$$\begin{aligned}(t-1)(r-1) &> 15 \\ (4-1)(r-1) &> 15 \\ 3(r-1) &> 15 \\ 3r-1 &> 15 \\ r &> 4\end{aligned}$$

Information:

t : Number of treatments
r : Number of replications



Information:

- 01 : Treated group
- 02 : Group after being given treatment
- 03 : The control group before not given treatment
- 04 : The control group after not being given treatment
- X : Treatment

Making *Baiting Gel*: Prepare 20 grams of strawberry jam, plus 50 grams of peanut butter then mixed with 30 grams of boiled chicken eggs, Blend the three ingredients until smooth, and no need to add water so that the resulting dough is similar to pasta so it's easy to apply.

Add the dose used according to the treatment. The dose used was 0 grams of borax as control and treatment (10 grams of borax, 15 grams of borax, and 30 grams of borax). Each *Baiting Gel* formulation weighed 100 grams for each treatment. Each application plate is filled with *Baiting Gel* for each dose combination weighing 20 grams for each treatment

Research Treatment: Enter 5 *Periplaneta americana* cockroaches in cages measuring 40 X 40 X 40 with a combination of *Baiting Gel* weighing 20 grams for each treatment with a dose of 0 grams as control and treatment (10 grams of borax, 15 grams of borax, and 30 grams of borax). Repeat each treatment 4 times. Weigh the *Baiting Gel* before placing it in the cage. Observe mortality every 12 hours. Record cockroach deaths. Weigh the *Baiting Gel* after the experiment. The scope of this research material is vector control, especially the mechanical vector

control of the *Periplaneta americana* cockroach species using chronic poison which is applied in the form of *Baiting Gel*.

The data collection method used in this research is through the measurement of several parameters including physical quality, temperature, humidity and light intensity. Calculations were used to determine the amount of cockroach *Baiting Gel* consumption and cockroach mortality.

Analysis of the data used in this study is an analysis of the effect of *Baiting Gel* replication with the active ingredient borax on the mortality of *Periplaneta americana*. After the quantitative data was processed, then it was analyzed statistically using the Anova test if the distribution was normal, if not normal using Kruskal-Wallis to determine whether there was an effect of variations in *Baiting Gel* dosage with the active ingredient borax on *Periplaneta americana* mortality.

C. Results and Discussion

1. Baiting Gel

Baiting Gel used for the experimental dose came from peanut butter, strawberry jam and chicken egg white with borax added as a poison. *Baiting Gel* was made at the PVBP Laboratory, Campus VII Poltekkes Semarang. The basic ingredients of *Baiting Gel* consist of 50 grams of peanut butter, 30 grams of chicken egg white and 20 grams of strawberry jam. The dose of borax given was 0 grams of borax, 10 grams of borax, 15 grams of borax, and 30 grams of borax.

2. Condition of *Periplaneta americana*

Periplaneta americana used for research is the imago phase because in that phase it is already able to eat soft foods such as *Baiting Gel*. *P.americana* used in this study was obtained from residential areas.

3. Room Temperature

Table 1. Research Room Temperature Measurement Results

No	Perlakuan	Waktu	Replikasi				Rata rata suhu
			1	2	3	4	
1.	Perlakuan 1	3 hari	24° C	24° C	22° C	22° C	23° C
2.	Perlakuan 2	3 hari	24° C	23° C	23° C	22° C	23° C
3.	Perlakuan 3	3 hari	23° C	24° C	24° C	23° C	23,5° C
4.	Perlakuan 4	3 hari	23° C	24° C	22° C	23° C	23° C
Rata rata							23,1° C

4. Room Humidity

Table 2. Research Room Humidity Measurement Results

No	Perlakuan	Waktu	Replikasi				Rata rata suhu
			1	2	3	4	
1.	Perlakuan 1	3 hari	91%	86%	91%	87%	88,7%
2.	Perlakuan 2	3 hari	94%	99%	87%	91%	92,7%
3.	Perlakuan 3	3 hari	89%	92%	86%	87%	88,5%
4.	Perlakuan 4	3 hari	91%	87%	89%	94%	90,2%
Fata rata							90,1%

5. Room Lighting

Table 3. Research Room Lighting Measurement Results

No	Perlakuan	Waktu	Replikasi				Rata rata suhu
			1	2	3	4	
1.	Perlakuan 1	3 hari	86 lux	80 lux	99 lux	88 lux	88,2 lux
2.	Perlakuan 2	3 hari	100 lux	87 lux	97 lux	98 lux	95,5 lux
3.	Perlakuan 3	3 hari	80 lux	85 lux	87 lux	94 lux	86,5 lux
4.	Perlakuan 4	3 hari	84 lux	87 lux	91 lux	89 lux	87,7 lux
Rata rata							89,5 lux

6. Consumption of *Baiting Gel Periplaneta americana*

Table 4. Baiting Gel Consumption Measurement Results

No	Dosis	Waktu	Replikasi				Rerata Hasil Konsumsi
			1	2	3	4	
1.	0 gram boraks	3 hari	4 gr	3 gr	4 gr	5 gr	3,25 gr
2.	10 gram boraks	3 hari	1 gr	1 gr	1 gr	1 gr	1 gr
3.	15 gram boraks	3 hari	3 gr	3 gr	2 gr	3 gr	2,75 gr
4.	30 gram boraks	3 hari	2 gr	3 gr	3 gr	2 gr	2,5 gr
Rata rata							2,375 gr

7. Periplaneta americana Mortality Average

Table 5. *Periplaneta americana* mortality

No	Dosis	Waktu	Replikasi				Σ <i>Periplaneta americana</i>	
			1	2	3	4	Kecoa Uji	Kematian Kecoa
1	0 gram boraks	3 hari	0	0	0	0	20	0
2	10 gram boraks	3 hari	0	0	1	1	20	18
3.	15 gram boraks	3 hari	2	1	1	2	20	14
4.	30 gram boraks	3 hari	1	0	2	2	20	15

8. Effect of borax dose on mortality Imago *Periplaneta americana*

Table 6. *Kruskal-Wallis* Test Results Borax Dose Mortality *Periplaneta americana*

Dosis Boraks	
Chi-square	5.702
df	3
Asymph. Sig.	0,127
Keterangan	Tida Ada Perbedaan

9. Effective dose

Table 7. Effective *Baiting Gel* Dosage

No	Dosis	Replikasi	mortalitas	% mortalitas	Keterangan
1	dosis 0 gram boraks	1	0	0 %	rerata mortalitas
2	dosis 0 gram boraks	2	0	0 %	<i>Periplaneta americana</i>
3	dosis 0 gram boraks	3	0	0 %	dosis 0 gram boraks = 0 (0 %)
4	dosis 0 gram boraks	4	0	0 %	
9	dosis 15 gram boraks	1	2	40 %	
10	dosis 15 gram boraks	2	1	20 %	<i>Periplaneta americana</i> mortalitas
11	dosis 15 gram boraks	3	1	20 %	cana pada aplikasi
12	dosis 15 gram boraks	4	2	40 %	dosis 15 gram boraks = 1,5 (30 %)
13	dosis 30 gram boraks	1	0	0 %	rerata mortalitas
14	dosis 30 gram boraks	2	1	20 %	<i>Periplaneta americana</i>
15	dosis 30 gram boraks	3	2	40 %	dosis 30 gram boraks
16	dosis 30 gram boraks	4	2	40 %	

10. Application Time

Table 8. The most effective App Time

No	Dosis	Replikasi	mortalitas pada 12 jam ke-					
			1	2	3	4	5	6
1	dosis 0 gram boraks	1	0	0	0	0	0	0
2	dosis 0 gram boraks	2	0	0	0	0	0	0
3	dosis 0 gram boraks	3	0	0	0	0	0	0
4	dosis 0 gram boraks	4	0	0	0	0	0	0
Min			0	0	0	0	0	0
Max			0	0	0	0	0	0
Rata rata			0	0	0	0	0	0
1	dosis 10 gram boraks	1	0	0	0	0	0	0
2	dosis 10 gram boraks	2	0	0	0	0	0	0
3	dosis 10 gram boraks	3	0	0	0	0	0	1
4	dosis 10 gram boraks	4	0	0	0	0	0	1
min.			0	0	0	0	0	1
max.			0	0	0	0	0	1
rata-rata			0	0	0	0	0	0,5
5	dosis 15 gram boraks	1	0	0	0	0	1	1
6	dosis 15 gram boraks	2	0	0	0	0	0	1
7	dosis 15 gram boraks	3	0	0	0	0	0	1
8	dosis 15 gram boraks	4	0	0	0	0	2	0
min.			0	0	0	0	1	1
max.			0	0	0	0	2	1
rata-rata			0	0	0	0	0,75	0,75
9	dosis 30 gram boraks	1	0	1	0	0	0	0
10	dosis 30 gram boraks	2	0	0	0	0	0	0
11	dosis 30 gram boraks	3	0	0	0	0	0	2
12	dosis 30 gram boraks	4	0	0	0	0	0	2
min.			0	1	0	0	0	0
max.			0	1	0	0	0	0
rata-rata			0	0,25	0	0	0	1

The research was carried out at the Vector and Pest Control Laboratory (PVBP) Campus VII Poltekkes Kemenkes Semarang, the researchers chose this location because the PVBP laboratory is a place specifically designed as a location for student practice and research, especially in the field of vectors and nuisance animals. Researchers built an experimental cage in a metal shop in Rempoah Village. Researchers made 4 cages to be used for research, 3 cages were used by researchers as experimental sites, 3 doses of *Baiting Gel*, 1 cage was used as a place to collect cockroaches or research objects to be tested. Making drums takes three days. In addition to making cages, the research location is also used as a place for collecting cockroaches from the catch.

Baiting Gel used for the experimental dose was derived from peanut butter, strawberry jam and chicken egg white which was added with borax as a chemical poison.

Researchers looked for the basic ingredients of *Baiting Gel*, such as peanut butter and strawberry jam, at a cake shop in Purwokerto, while for egg whites, researchers took them to a shop near their house. For the poison material, namely borax, the researchers bought it at PT Himmedia.

For the manufacture of *Baiting Gel*, previous researchers mixed basic ingredients such as peanut butter, strawberry jam, and egg whites that had been measured according to their respective sizes. Furthermore, the ingredients that have been mixed are

put into a mixer so that the mixture can be softer. After being soft, the *Baiting Gel* material was mixed with borax in a mortar according to the size of each treatment. Researchers did not mix borax in the mixer, because they were worried that a lot of the borax used would be left behind in the mixer. Therefore, the researchers mixed borax with *Baiting Gel* material of 100 grams with mortar and pestle, so that the borax mixture could be mixed evenly on the *Baiting Gel* material. After being evenly mixed, the researcher then weighed back 20 grams which would be put on the plate as an experimental site.

After the *Baiting Gel* mixture was mixed with borax, the researchers transferred the mixture to a *Baiting Gel* applicator of 20 grams before placing it on the *Baiting Gel* plate or place. With the help of the *Baiting Gel* applicator, the texture of the *Baiting Gel* can be better, so it is hoped that it will attract *Periplaneta americana* to consume more *Baiting Gel*.

The *P.americana* used in this study was obtained from residential houses. *P.americana* used for research is the imago phase measuring about 4 cm long and about 7 mm high, where in that phase it is able to eat soft foods in solid form with high water, sugar, and protein content according to the texture and content of the *baiting Gel*.

The condition of the cockroach during the study must also be good, we can see this with the complete body structure of *Periplaneta americana*. *P.americana's* fast and agile movements indicate that *P.americana* is in good and healthy condition. To maximize the condition of the cockroaches to be hungry for consuming *Baiting Gel* during the experiment, the researchers gave *Baiting Gel* food without poison which aims to get cockroaches to get to know the food. During the pre-experiment, researchers fasted *P.americana* for 2 to 3 days but were still given water on certain days, it is hoped that by fasting *P.americana* can make hungry conditions during the experiment, with this hungry condition it is expected to make *P.americana* more voracious in consuming *Baiting Gel*. The larger the *Baiting Gel* eaten, it is expected to accelerate mortality in *P.americana*.

During the research, the room temperature conditions remained stable, ranging from 22°C - 24°C with the average temperature as shown in table 4.1, which is 23.1°C. With these room temperature conditions, it can be concluded that the room temperature is suitable for the survival of cockroaches so it is expected to be a contributing factor to the success of toxic bait or *Baiting Gel* for the control of *Periplaneta americana*.

During the study, the humidity conditions of the research room remained stable ranging from 86% - 99% with the average humidity as shown in table 4.2, which was 90.1%. With the humidity conditions in the room, it can be concluded that the humidity in the

room is suitable for the survival of cockroaches so it is expected to be a contributing factor to the success of toxic bait or *Baiting Gel* for *P.americana* control.

With a lighting condition of 89.5 lux, this is still categorized as a bright condition. It can be seen that cockroaches like dark conditions. Therefore, the researchers modified the cage by covering the cage with black cloth so that the conditions of the cage looked dark and made the cockroaches feel comfortable while in the cage. With dark cage conditions, it is hoped that it can be a contributing factor to the success of toxic bait or *Baiting Gel* for the control of *Periplaneta americana*.

The results of the amount of *Baiting Gel* consumption can be seen by the results of the difference in the amount of *baiting gel* before treatment and after treatment. In replication 1, a dose of 0 grams of borax or treatment 1 had a total consumption of 2 grams of *Baiting Gel*, a dose of 10 grams of borax or treatment 2 had a total consumption of *Baiting Gel* of 5 grams, a dose of 15 grams of borax or treatment 3 had a total consumption of *Baiting Gel* of 4 grams and a dose of 30 grams of borax or treatment 4 has a total consumption of 5 grams of *Baiting Gel*.

In replication 2, a dose of 0 grams of borax or treatment 1 had a total consumption of *Baiting Gel* of 4 grams, a dose of 10 grams of borax or treatment 2 had a total consumption of *Baiting Gel* of 1 gram, a dose of 15 grams of borax or treatment 3 had a total consumption of *Baiting Gel* of 1 gram and a dose of 30 grams of borax or treatment 4 has a total consumption of 1 gram of *Baiting Gel*.

In replication 3, a dose of 0 grams of borax or treatment 1 had a total consumption of 3 grams of *Baiting Gel*, a dose of 10 grams of borax or treatment 2 had a total consumption of *Baiting Gel* of 3 grams, a dose of 15 grams of borax or treatment 3 had a total consumption of *Baiting Gel* of 2 grams and a dose of 30 grams of borax or treatment 4 has a total consumption of 3 grams of *Baiting Gel*.

In replication 4, a dose of 0 grams of borax or treatment 1 had a total consumption of *Baiting Gel* of 4 grams, a dose of 10 grams of borax or treatment 2 had a total consumption of *Baiting Gel* of 3 grams, a dose of 15 grams of borax or treatment 3 had a total consumption of *Baiting Gel* of 3 grams and a dose of 30 grams of borax or treatment 4 has a total consumption of 2 grams of *Baiting Gel*.

The average consumption of *Baiting Gel* for 3 days by *Periplaneta americana* after the test obtained the results of *Baiting Gel* consumption at a dose of 0 grams of borax of 3.25 grams, a dose of 10 grams of borax of 1 gram, a dose of 15 grams of borax of 2.75 grams and a dose of 30 grams borax of 2,375 grams.

Based on these data, the treatment given by borax has a fairly high consumption power. This can happen because *Baiting Gel* which is given borax has

a longer resistance. The long durability is due to the borax content in *Baiting Gel* which can prevent fungus, bacteria, yeast so that *Baiting Gel* food will last longer.

Therefore, it can be concluded that *Baiting Gel* with borax compounds can preserve the cockroach's food because it prevents the arrival of microorganisms that cause spoilage. With the prevention of spoilage from microorganisms, *Periplaneta americana* prefers to consume *Baiting Gel* provided by researchers.

The *P.americana* mortality test is one of the tests to determine whether the *Baiting Gel* application can be used to control cockroaches or not. The age and condition of the cockroach is one of the factors that influence the mortality of cockroaches on the *Baiting Gel* application. Therefore we need to know the phase and condition of the cockroach according to the *Baiting Gel* application that we use. The cockroach phase that we will use is the imago phase because it matches the *Baiting Gel* texture that we will use.

Imago *Periplaneta americana* was declared dead when the cockroach was unable to move its body and the body position of the cockroach was upside down or in the ventral position of the cockroach it was unable to move its body again. The mortality of these cockroaches was due to the content of borax which is chemically toxic so it can be toxic to *P.americana* even though its toxicity is low for humans and mammals.

In replication 1, treatment 1 as a control with a dose of 0 grams of borax contained 0 mortality of *P.americana*, a dose of 10 grams of borax or treatment 2 had *P.americana* mortality of 0 individuals, a dose of 15 grams of borax or treatment 3 had *P. americana* mortality of 2 tails, dose of 30 grams of borax or treatment 4 there is a mortality of *P.americana* of 1 tail.

In replication 2, treatment 1 as a control with a dose of 0 grams of borax contained *Periplaneta americana* mortality of 0 individuals, a dose of 10 grams of borax or treatment 2 contained 0 mortality of *P.americana*, a dose of 15 grams of borax or treatment 3 had *P.americana* mortality of 1 tail, a dose of 30 grams of borax or treatment 4 there was a *P.americana* mortality of 0 individuals.

In replication 3, treatment 1 as a control with a dose of 0 grams of borax contained 0 *P.americana* mortality, a dose of 10 grams borax or treatment 2 had 1 *P.americana* mortality, a dose of 15 grams borax or treatment 3 had *P mortality. Americana* of 1 tail, a dose of 30 grams of borax, or treatment 4 contained 2 tails of *P.americana mortality*.

In replication 4, treatment 1 as a control with a dose of 0 grams of borax contained 0 mortality of *P.americana*, a dose of 10 grams of borax or treatment 2 had a mortality of *P.americana* of 1 tail, a dose of 15 grams of borax or treatment 3 had a mortality of *P.*

Americana by 2 tails, a dose of 30 grams of borax or treatment 4 there were 2 tails of *P.americana* mortality.

Periplaneta americana average mortality after being tested using *Baiting Gel*. The average mortality of cockroaches with a dose of 0 grams of borax is 0%, a dose of 10 grams of borax is 10%, a dose of 15 grams of borax is 30%, a dose of 30 grams of borax is 25%.

Based on table 7, we can conclude that the use of borax in *Baiting Gel* can cause mortality of *Periplaneta americana*, we can prove this by looking at table 4.7 with the results of the average mortality of *P.americana* at the application dose of 10 grams of borax = 0.5 (10%), the dose 15 grams of borax = 1.5 (30%) and a dose of 30 grams of borax = 1.25 (25%). The higher the dose, the higher the mortality of *P.americana*, but there are several things that influence why at a dose of 30 grams of borax there is a decrease in mortality of *P.americana*, one of which is the occurrence of mortality on the first day so that there is a deterrent to baiting the other test cockroaches.

After the normality test was carried out, it turned out that the data was not normal, therefore it was continued with the *Kruskal Wallis* test as in table 4.6 for the effect of borax dose on the mortality of *Periplaneta americana*, the significant result was $p = 0.127 > 0.05$, which means that there was no effect of the application of variations in the dose of borax. on the mortality of *P.americana*. It can be interpreted that the dose given by the researcher is not high enough so that it does not cause mortality in accordance with the efficacy theory, which causes death up to 80%, while the results obtained by the researcher only cause the highest mortality of 30%.

Based on observations during the study, the mortality of *Periplaneta americana* was caused by the toxins present in the *Baiting Gel*. The poison in *Baiting Gel* is borax. The poison is a stomach poison, where the stomach poison will start working after entering through the mouth, and into the stomach of the imago *P.americana*.

The results of the most effective *Baiting Gel* application time as shown in table 4.8 can be seen that at a dose of 10 grams of borax the average mortality in the first 12 hours is 0, the average mortality in the second 12 hours is 0, the average mortality in the third 12 hours is 0, the average mortality in the third 12 hours is 0, the average mortality at the fourth 12 hours was 0, the average mortality at the fifth 12 hours was 1, and the average mortality at the sixth 12 hours was 0.5.

At a dose of 15 grams of borax the average mortality in the first 12 hours was 0, the average mortality in the second 12 hours was 0, the average mortality in the third 12 hours was 0, the average mortality in the fourth 12 hours was 0, the average

mortality at the fifth 12 hours was 0.75, and the meanmortality at the sixth 12 hours was 0.75.

At a dose of 30 grams of borax the average mortality in the first 12 hours was 0, the average mortality in the second 12 hours was 0.25, the average mortality in the third 12 hours was 0, the average mortality in the fourth 12 hours was 0, the average mortality at the fifth 12 hours was 0, and the average mortality at the sixth 12 hours was 1.

Based on the data above, it can be concluded that the most effective time for *Periplaneta americana* mortality is in the sixth 12 hours. This can be concluded because the dose treatment in each experiment during the 6th 12-hour exposure continued to increase mortality.

D. Conclusions and suggestion

1. Conclusions

The average measurement of room temperature is 23.10C, humidity is 90.1% and lighting is 89.5 lux. The average amount of *Baiting Gel* consumption at a dose of 0 grams of borax is 4 grams, 10 grams of borax is 1 gram, a dose of 15 grams of borax is 2.75 grams, and a dose of 30 grams of borax is 2.5 grams. The average mortality of *Periplaneta americana* at a dose of 0 grams of borax was 0%, a dose of 10 grams of borax was 10%, a dose of 15 grams of borax was 30%, and a dose of 30 grams of borax was 25%. The results of the *Kruskal Wallis* test analysis showed p-value = 0.127 0.05, meaning that there was no effect of application of boraX dosage variations on *Baiting Gel* on *Periplaneta americana* mortality. The most effective application time to *Periplaneta americana* mortality at each dose: The effective time of the dose of 10 grams of borax in the sixth 12 hours with a mean mortality of 0.5; The effective time of the dose of 15 grams of borax in the fifth and sixth 12 hours with a mean mortality of 0.75; The effective time of the dose of 30 grams of borax in the sixth 12 hours with a mean mortality of 1.

2. Suggestion

It is hoped that other researchers can conduct further research using a combination of

Borax and Sulfur to be more effective in killing the *Periplaneta americana* cockroach.

E. Thank-you note

Thank you to the PVBP Laboratory of Campus VII Poltekkes, Ministry of Health, Semarang, which has helped facilitate the implementation of this research

F. Bibliography

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