

PHILIPPINE SCIENCE HIGH SCHOOL WESTERN VISAYAS

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Iloilo City

THE FEASIBILITY OF *Anona Squamosa* LEAVES AS AN INSECT REPELLENT
ADDITIVE TO SAND-CAST CANDLE

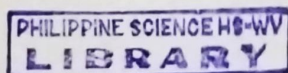
A Research Paper Presented to the
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Iloilo City

In Partial fulfillment
of the Requirements in
Science Research II

by

Jeveeh B. Azucena
John Joel E. Belleza
Daystar S. Sedillo

March 2001



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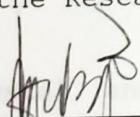
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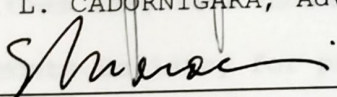
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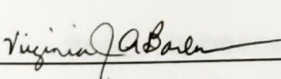
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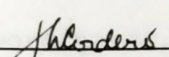
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Above all, to God Almighty, for giving us the wisdom and strength to surpass all His tests.

Iloilo City, March 2001

JEVEEH B. AZUCENA

JOHN JOEL E. BELLEZA

DAYSTAR S. SEDILLO

March 2001

To test for the effectiveness, the produced remedy was tested on specimens. Three trials were performed involving three different concentration of this leaves proportions of the paraffin wax. The results of the test were recorded on a table using the One-Way Analysis of Variance, set at 0.05 alpha level of significance. The study hypothesized that there is no significant difference in the effectiveness among the different amounts of concentration of this leaves in the wood-boring species in terms of the number of specimens killed and dried away.

Results showed that this leaves are feasible as an insect-repellent material in wood-boring control. The active principle, which is possessed by the leaves, may be an effective insect-repellent.

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Abstract

This study aimed to determine the feasibility of *Anona squamosa* leaves as an insect-repellent additive to sand-cast candle. To test for its effectiveness, the produced candle was tested on mosquitoes. Three trials were performed involving three different concentration of atis leaves proportions of the paraffin wax. The results of the test were recorded on a table using the One-Way Analysis of Variance, set at 0.05 alpha level of significance. The study hypothesized that there is no significant difference in the effectiveness among the different amounts of concentration of atis leaves in the sand cast candle in terms of the number of mosquitoes killed and driven away.

Results showed that atis leaves are feasible as an insect-repellent additive to sand-cast candle. The acrid principle, which is possessed by the leaves made it an effective insect-repellent.

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TABLE OF CONTENTS

Chapter		Page
1	INTRODUCTION TO THE STUDY	
	Background of the Study	1
	Statement of the Problem and Hypothesis	4
	Significance of the Study	5
	Scope and Delimitation	5
	Definition of Terms	6
2	REVIEW OF RELATED LITERATURE	
	Atis (<i>Anona squamosa</i>)	8
	Insect	9
	Insecticides	9
	Repellents	10
	Volatile oils	10
3	RESEARCH DESIGN AND METHODOLOGY	
	Research Design	12
	Methodology	
	Preparation of Materials	13
	Preparation of Mixture	13
	Preparation of the Mold	14
	Determining the Effectiveness of the Candle	14
	Statistical Data Analysis	14

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Chapter		Page
4	RESULTS	
	Feasibility of Insect-repellent Sand-cast Candle Added with Atis Leaves	16
	Effectiveness of Insect-repelling Sand-cast Candle	17
	Differences in the effectiveness of the Insect-repellent Sand-cast candle with Different Concentration of Grounded Atis Leaves	17
5	FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS	
	Findings	21
	Conclusions	21
	Recommendations	22
	REFERENCES	23

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LIST OF TABLES

Table		Page
1	Means of Mosquitoes Killed and Repelled at Different Concentration	18
2	One-Way for ANOVA for Effectiveness of Sand-Cast Candle at Different Concentration in Killing and Repelling Mosquitoes	19

PHILIPPINE SCIENCE HIGH SCHOOL WESTERN VISAYAS
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LIST OF FIGURES

Figure		Page
1	The Number of Mosquitoes Killed and Repelled Affected by the Different Amounts of <i>Anona Squamosa</i> Leaves in Sand-cast Candle	3

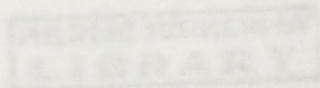
Chapter 1

Introduction to the Study

Background of the Study

Life forms that in some manner cause injury to human food supplies or living areas or that acts as parasites or disease vectors are considered pests. Although various techniques are available or being developed, the most familiar and widespread technique in the 20th century is the use of pesticides.

However, environmentalists, scientists and workers in the pesticide industry have also contended that some pesticide compounds are hazardous to human health (Encyclopedia, 1994). Workers in factories that produce some these compounds have, in the process of bringing legal action against some manufacturers, received financial compensation for illness allegedly caused by exposure to these pesticides.



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1

THE FEASIBILITY OF *Anona squamosa* LEAVES AS AN INSECT-REPELLENT
ADDITIVE TO SAND-CAST CANDLE

Chapter 1

Introduction to the Study

Background of the Study

Life forms that in some manner cause injury to human food supplies or living areas or that acts as parasites or disease vectors are considered pests. Although various techniques are available or being developed, the most familiar and widespread technique in the 20th century is the use of pesticides.

However, environmentalists, scientists and workers in the pesticide industry have also contented that some pesticide compounds are hazardous to human health (Grollier's Encyclopedia, 1994). Workers in factories that produce some of these compounds have, in the process of bringing legal suites against some manufacturers, received financial compensation for illness allegedly caused by exposure to these chemicals.

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2

Also, many insects carry diseases fatal to humans and livestock. Some of the diseases include sleeping sickness, bubonic plague, malaria, typhoid fever, dysentery, and cholera. Since people today suffer from poverty, especially in the squatters area they remain unhealthy for the rest of their lives. They cannot provide themselves with proper medication. They just provide themselves with repellents. But what they do not know that these repellents contain compounds that are hazardous to their health.

In order to prevent the problems of our people, this study came about. This will use atis leaves as an additive to a candle which would make the candle insect repellent and at the same time, environment-friendly.

In this study, the independent variable will be the different amounts of dry leaf powder of atis leaves in the sand cast candle. The dependent variables will be the number of mosquitoes killed and driven away.

The relationship between the dependent and the independent variables in the study is presented in Figure 1.

Figure 1. The number of mosquitoes killed and driven away affected by the different amounts of *Atis* squashes leaves in sand-cast candle.

INDEPENDENT VARIABLE

DEPENDENT VARIABLE

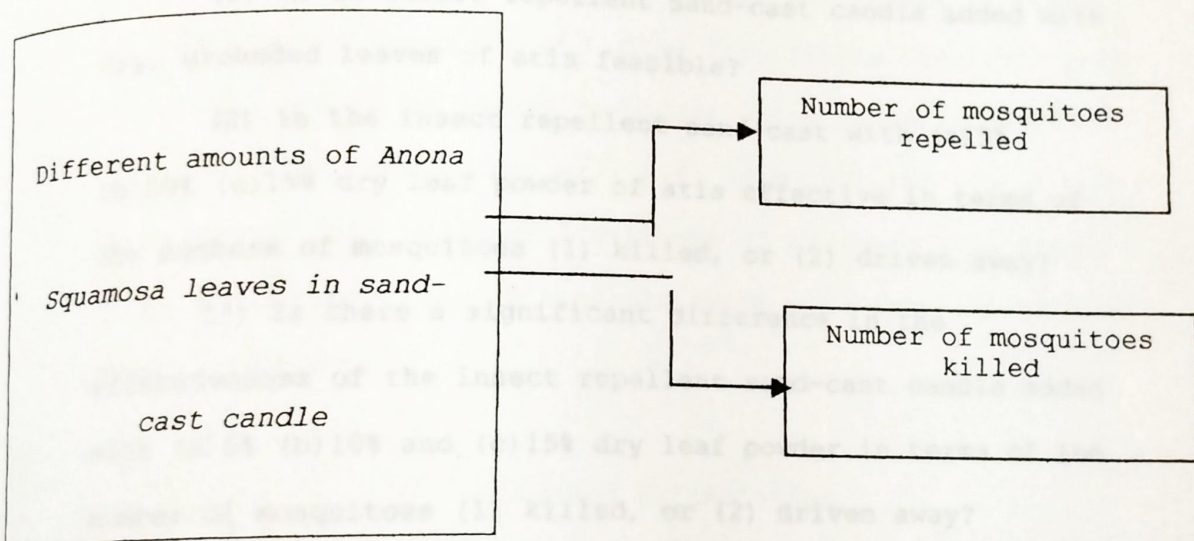


Figure 1. The number of mosquitoes killed and driven away affected by the different amounts of *Anona squamosa* leaves in sand-cast candle.

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4

Statement of the Problem and Hypothesis

This study will aim to determine the feasibility of *Anona squamosa* as an insect repellent additive to sand-cast candles.

Specifically, it will answer the following questions:

(1) Is an insect repellent sand-cast candle added with dry, grounded leaves of atis feasible?

(2) Is the insect repellent sand-cast with (a)5% (b)10% (c)15% dry leaf powder of atis effective in terms of the numbers of mosquitoes (1) killed, or (2) driven away?

(3) Is there a significant difference in the effectiveness of the insect repellent sand-cast candle added with (a)5% (b)10% and (c)15% dry leaf powder in terms of the number of mosquitoes (1) killed, or (2) driven away?

It is hypothesized that there is no significant difference in the effectiveness of the insect repellents sand-cast candle added with (a)5% (b)10% and (c)15% dry leaf powder in terms of the number of mosquitos (1)killed or (2)driven away.

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5

Significance of the Study

At present, there are a variety of commercial candles sold in different stores all over the country. Most of them are made out of ordinary materials like paraffin. However, a special candle has been made with added ingredients to make it repellent to mosquitos and other tiny flying insects. This study will create an insect repellent which is not harmful to humans when inhaled and will also help beat the economic crisis since this study will make use of ordinary atis leaves as an added ingredient to a candle which will make the candle insect repellent.

Scope and Delimitation

The study involved the gathering of the mosquitoes. The researchers had a slight problem in gathering the mosquitoes and the researchers had difficulty in counting the repelled and killed mosquitoes.

Definition of Terms

Anona squamosa- is a maple of eastern North America, whose sweet sap is the chief source of maple sugar (The Random House Dictionary, 1978).

In this study, this term will be referred to the atis leaves, whose dry powder will be used as added ingredient to the candle which will make it potential as insect repellent candle.

Candle- is a long, usually slender piece of tallow or wax with an embedded wick, burned to give light (The Random House Dictionary).

In this study, this term is referred to as the product which was added with atis extract and whose insect repellent capability will be measured.

Insect- is any one of more than 800,000 kinds of small, six-legged animals in class Insecta. They have a hard skeleton on the outside of their bodies and most of them have four stiff wings (Young People's Science Encyclopedia, 1970).

In this study, this term will refer to mosquitoes, which are the of the experiment to be exposed to the sand-cast candle.

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7

Repellent- A substance that repels something; not penetratable by a specified substance (Oxford American Dictionary, 1980).

In this study, the term will refer to the sand cast candle.

Additive- an added ingredient to a substance (Oxford-American Dictionary).

In this study, the term will refer to the dry powder of atis leaves which will be added to the candle.

Effectiveness- producing an effect; a change produced by an action or cause (Oxford American Dictionary).

In this study, the term will refer to the number of mosquitoes killed or driven away.

Volatile oil- a rapidly evaporating oil, especially an essential oil, that leaves no stain (Webster's II New Riverside University Dictionary, 1984).

In this study, the term meant as defined.

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8

Chapter 2

Review of Related Literature

Chapter 2 is composed of four parts, namely (1) Atis, (2) Insects, (3) Insecticides, (4) Repellents.

Atis (*Anona squamosa*)

Atis, *Anona squamosa*, is cultivated through out the Philippines and is occasionally spontaneous. It was introduced from tropical America by the Spaniards at an early date is now pantropic in cultivation. The plant is a small tree 3 to 5 meters in height. The leaves are hairy when young, oblong, and 8 to 15 centimeters in length, with the petiole of 1 to 1.5 centimeters long. The flowers occur singly in the axils of the leaves and are about 2.5 centimeters long. They are pendulous, hairy, three-angled, and greenish-white or yellowish. The fruit is large, somewhat heart-shaped, and 6 to 9 centimeters length. The outside of the fruit is marked by polygonal tubercles. When the fruit is ripe, it is a light yellowish green. The flesh is white, sweet, soft, and juicy, and has a mild, very agreeable flavor.

Externally, the leaves, the unripe fruit, and the seeds, which contain acrid principle, possesses vermicidal and insecticidal properties (Sanyal and Ghose, 1978).

Insects

An insect is any one of more than 800,000 kinds of small, six-legged animals in class Insecta. Insects have a hard skeleton on the outside of their bodies. Some insect adults are wingless but most of kinds have four stiff wings.

Insects develop in one of two ways. In one type of life cycle, the egg hatches as a worm-like larva. After the larva eats, grows, and shed its skin several times, it changes to a resting pupa stage. Later, the pupal case splits and out comes an adult. This is complete metamorphosis.

Millions of dollars of damage occur each year from such destroyers as cotton weevils, corn borers, clothes moths, fruit-tree pests, and disease-bearing flies.

Insecticides

Insecticides are poisonous chemicals used to kill insects. Their use protects men's food supply and forests from harmful insects and prevents the spread of insect-borne diseases. A

substance developed to control pests such as mice and weeds is called a pesticide. Insecticides are used to rid crops of destructive insects such as grasshoppers and to clean livestock of fleas, ticks or lice, which all carry and spread diseases.

Although insecticides are useful in protecting crops and livestock, they can also cause problems. These chemicals are dangerous when inhaled. They can cause death and infertility.

The current controversy over the harmful effects of insecticides on wildlife and humans is causing man to turn to other methods.

Repellent

Botanical pesticides were made from dried and ground leaves, flowers, stems, and roots, all of which contained active pesticidal agents such as alkaloids, glycosides, esters, coumarins, or essential oils such as terpenoids.

Volatile Oils

According to Remington's Pharmaceutical Sciences (in Hoover, 1975), volatile oils, or essential oils, are found in various plant organ and tissues. They usually constitute the

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11

savory and odorous principles of the plants in which they exist, and they either pre-exist in the tissues or are produced by the reactions of certain constituents when the tissues are brought into contact with water. Volatile oils are sometimes formed through destructive distillation, as the oils of tar and amber, these being occasionally referred to as pyrolea.

Most of the volatile oils are colorless when pure and fresh, or can be made colorless by redistillation. Upon exposure to air they acquire various colors, becoming green, as in oil of wormwood; yellow as in oil of peppermint; red, as in oil of origanum; brown, as in oil of cinnamon. The blue color and oil of chamomile is an inherit property of the oil even when freshly distilled and is said to be due to the highly unsaturated hydrocarbon chamazulene ($C_{15}H_{18}$).

The odors of volatile oils are extremely variable. It is their most characteristic feature. The odor of the oil is sensibly modified by exposure to the air.

The factorial Post-test Design was used in this study.

The different amounts of dry Summary powder added to sand

that cradle was the independent variable, while the number

The related literature expresses that pests are harmful to humans. But the use of pesticide is hazardous to human health. As an alternative, the use of atis leaves is considered since it contains insecticidal properties.

Chapter 3

Research Design and Methodology

This study aimed to determine the insect-repelling ability of the candle when *Anona squamosa* leaves are added as one of its ingredients.

It was hypothesized that there is no significant difference in the effectiveness of the insect-repellers sand-cast candle added with (a) 5% (b) 10% (c) 15% dry leaf powder in terms of the number of mosquitoes (1) killed or (2) driven away.

In this study, the independent variable is the different amounts of dry leaf powder of atis leaves in the sand-cast candle. The dependent variable is the number of mosquitoes killed and driven away.

The Research Design

The Pre-test Post-test Design was used in this study. The different amounts of dry Atis leaf powder added to sand cast candle was the independent variable, while the number of mosquitoes killed or driven away by the candle was the dependent variable.

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13

There were four test group. The first test group included the candle with 5% amount of ground Atis leaves, the second with 10%, the third with 15%, and the last test group was the control group (0%). The Pre-test was measuring the number of mosquitoes killed or driven away by ordinary candle. The post-test was measuring the number of mosquitoes killed or driven away using candles with different amounts of atis leaves. Three trials were done for the four test groups.

Methodology

Preparation of Material

The materials used in this study were ten grams of coconut oil (for every candle), 100 grams paraffin wax (for every candle), ground dried atis leaves, sand, wick, straight wire, hot plate, clay pot and a one-liter container.

Preparation of Mixture

100 grams of paraffin wax was placed in a one-liter container. A mixture of 10 grams of coconut oil and 5 grams of atis leaves were poured to the paraffin wax. For the next two candles, 10 grams and 15 grams of atis leaves were used. The mixture was heated until all the

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14

paraffin wax was melted. The mixture was poured into the mold. The control candle was also made, that is, without the leaf powder.

Preparation of the Mold

The mold for the candle was prepared by using the clay pot with 50 grams sand in it. A wick was attached to a straight wire, which was inserted at the bottom of the sand.

The mixture was poured into the mold and was cooled until it hardens. Then the candle was removed from the pot.

Determining the Effectiveness of the Sand-Cast Candle

The candle made was lighted and placed in a container or aquarium with a sample number of mosquitoes. The number of mosquitoes killed or driven away was recorded.

Statistical Data Analysis

The Mean and the Standard Deviation was used as the descriptive statistical tool. The t-test, set at 0.05 level of significance, was used to determine the significant difference in the pre-test and post-test results. The One-Way ANOVA, set at 0.05 level of significance, was used to

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15

determine the significant difference in the post-test results among the three different dry atis leaf powder and candle proportion.

This study aimed to determine the insect-repelling ability of the candle when *Atis* species leaves are added as one of its ingredients.

It was hypothesized that there is no significant difference in the effectiveness of the insect-repelling sand-cast candle added with 5g, 10g, and 15g dry leaf powder in terms of the number of mosquitoes killed or driven away.

In this study, the independent variable was the different amounts of dry leaf powder of atis leaves in the sand-cast candle. The dependent variable was the number of mosquitoes killed and driven away.

Feasibility of Insect-repellent Sand-Cast Candle Added with Atis Leaves

The insect-repelling sand-cast candle was feasible. The resulting candle is about 5 inches in height and has a brown color. The surface of the candle is rough.

The candle was tested for its effectiveness in terms of the number of mosquitoes killed and repelled. The repelling capabilities were observed and recorded starting from 1 minute until 3 minutes. The killing and repelling capabilities were

Chapter 4

Results

This study aimed to determine the insect-repelling ability of the candle when *Anona squamosa* leaves are added as one of its ingredients.

It was hypothesized that there is no significant difference in the effectiveness of the insect-repelling sand-cast candle added with 5%, 10%, and 15% dry leaf powder in terms of the number of mosquitoes killed or driven away.

In this study, the independent variable was the different amounts of dry leaf powder of atis leaves in the sand-cast candle. The dependent variable was the number of mosquitoes killed and driven away.

Feasibility of Insect-repellent Sand-Cast Candle Added with Atis Leaves

The insect-repelling sand-cast candle was feasible. The resulting candle is about 5 inches in height and has a brown color. The surface of the candle is rough.

The candle was tested for its effectiveness in terms of the number of mosquitoes killed and repelled. The repelling capabilities were observed and recorded starting from 1 minute until 3 minutes. The killing and repelling capabilities were

observed only after 3 minutes.

17

Effectiveness of Insect-repelling Sand-Cast Candle

The insect-repellent sand-cast candle with 5% grounded atis leaves was able to repel all of the 10 mosquitoes. However, it did not kill any mosquitoes at all.

The candle with 10% grounded atis leaves was able to repel 9 mosquitoes and kill one of the mosquitoes.

The candle with 15% grounded atis leaves was able to repel 8 mosquitoes and was able to kill 2 mosquitoes.

Table 1 shows the data.

Differences in the Effectiveness of the Insect-repellent Sand-Cast Candle Added with Different Concentration of Grounded Atis Leaves

The One-Way ANOVA showed that there is no significant difference in the killing and repelling capabilities of the insect-repellent sand-cast candle with 5%, 10%, and 15% grounded atis leaves, as reflected by $F(36) = 0.283$, $p > 0.05$.

Table 2 shows the data.

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Table 1.

Means of Mosquitoes Killed and Repelled at Different Concentration

Category	N	Mean	S.D.
Control -killed -repelled	10 10	0 1.0	0 0
5% -killed -repelled	10 10	0 1.0	0 0
10% -killed -repelled	10 10	0.10 0.90	0.32 0.32
15% -killed -repelled	10 10	0.20 0.80	0.42 0.42

Table 2.

One-Way for ANOVA for Effectiveness of Sand-Cast Candle at
Different Concentration in Killing and Repelling Mosquitoes

Category	Sum of Squares	Df	Mean Square	F	Significance
Mosquitoes repelled	-between groups	3	9.167×10^{-2}	1.320	0.283
	-within groups	36	6.944×10^{-2}		
	-total	39			
Mosquitoes killed	-between groups	3	9.167×10^{-2}	1.320	0.283
	-within groups	36	6.944×10^{-2}		
	-total	39			

Chapter 5

Findings, Conclusions, Recommendations

This study aimed to determine the feasibility of *Anona squamosa* as an insect repellent additive to sand-cast candles.

Specifically, it will answer the following questions:

(1) Is an insect repellent sand-cast candle added with dry, grounded leaves of atis feasible?

(2) Is the insect repellent sand-cast with (a) 5% (b) 10% (c) 15% dry leaf powder of atis effective in terms of the numbers of mosquito (1) killed, or (2) driven away?

(3) Is there a significant difference in the effectiveness of the insect repellent sand-cast candle added with (a) 5% (b) 10% and (c) 15% dry leaf powder in terms of the number of mosquitoes (1) killed, or (2) driven away?

It was hypothesized that there is no significant difference in the effectiveness of the insect repellents sand-cast candle added with (a) 5% (b) 10% and (c) 15% dry leaf powder in terms of the number of mosquitoes (1) killed or (2) driven away.

Findings

1. The insect repellent sand-cast candle with ground atis leaves was feasible. The candle is about 5 inches tall and has a rough surfaces and brown in color.

2a. Candle with 5% concentration at 3 min exposure
killed—The candle was not able to kill any of the mosquitoes.
repelled—The candle was able to repel all of the 10 mosquitoes.

2b. Candle with 10% concentration 3 min exposure
killed—The candle was able to kill 1 mosquitoes.
repelled—The candle was able to repel 9 mosquitoes.

2c. Candle with 15% concentration at 3 min exposure
killed—The candle was able to kill 2 mosquitoes.
repelled—The candle was able to repel 8 mosquitoes.

3. There was no significant difference in the effectiveness of the sand-cast candle added with 5%, 10%, and 15% ground atis leaves in terms of the number of mosquitoes killed or driven away.

Conclusion

The insect-repellent sand-cast candle was feasible. Though it did not kill any of the mosquitoes in the first two minutes, it was able to kill at least one mosquito after 3 minutes. The atis leaves have an effect in the candle. The candle with 5%

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22

concentration repels all of the mosquitoes but did not kill any of them. The candle with 10% mosquitoes was able to kill one of the mosquitoes and repel the remaining ones. The candle with 15% concentration was able to kill 2 mosquitoes and repel the remaining ones.

There was no significant difference among the different concentration of the ground atis leaves in the candle in terms of its ability to kill or repel mosquitoes.

Recommendations

After the results were tabulated, it showed that the atis leaves have an effect in the candle. It can be concluded from the results that prolonged exposure of the mosquitoes to the candle will have an effect to the mosquitoes; either they will be killed or repelled.

It is recommended that the amount of atis concentration should be increased to have a more feasible candle. It is also recommended by the researchers that the time exposure of the mosquitoes to the candle should be increased in order to determine the significant difference among the candle.

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23

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