# Pesticidal Property of Bakya *(Dieffenbachia amoena)* Leaf Extract against Yellow Rice Stem Borer *(Scirpophaga incertulas)*

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ABSTRACT

*This study aimed to determine the pesticidal property of "Bakya" (Dieffenbachia amoena) against Yellow Rice Stem Borers (Scirpophaga incertulas). The researchers utilized experimental method in collection and preparation of raw materials, extraction of Bakya leaves, formulation of Bakya pesticide, determination of physical and chemical properties of Bakya extract, and toxicity test, to identify the physical properties, i.e., odor, color, specific gravity, viscosity, and pH (acidity), chemical properties, i.e., solubility, and alkaloids, and lethal dosage, i.e., $LD_{50}$. The commercial pesticide, i.e., malathion, was used as a control substance.The findings of the study revealed the following: 1) the solvent extraction method using 95% ethyl alcohol was used to produce Bakya pesticide; 2) the odor of Bakya leaves extract emitted pungentodor while malathion exhibited an odor of garlic; 3) the dominant color for bakya extract was green while for Malathion was orange; 4) the viscosity of Malathion was greater than that of Bakya pesticide; 5) the specific gravity of Bakya pesticide in different temperatures were all lower compared to Malathion; 6) the mean pH of Bakya pesticide was 6.67 and Malathion was 0.7733. The optimum pH was 4.0 as prescribed by the European Food Safety Authority; 7) bakya pesticide was soluble in water, indicated that it has the presence of polar group, it is also soluble in HCI, it exhibited a great potential of toxicity but is insoluble in NaOH and $H_2SO_4$, hence it did not contain either Phenol or Carboxylic Group. Malathion is insoluble in all the compounds; 8) Both pesticides contain alkaloid; 9) The probits at 13% and at 25% is approximately 4. The LD value for the probit of 5 is 1.8 and $LD_{50}$ is equal to*

*63.10 mg/kg; and 10) There is a significant difference between the commercial pesticide and Bakya Dieffenbachia amoena pesticide. The $LD_{50}$ of Bakya pesticide was determined using the Yellow Rice Stem Borer. One out of ten Yellow Rice Stem Borers was found dead after spraying the Bakya pesticide. The $LD_{50}$ was found out to be 63.10 mg/kg.The acute oral $LD_{50}$(rat) is equal to 72mg/kg.The findings showed that in using 10% and 20% formulations, there were no observable fatalities among the Yellow Rice Stem Borers. However, using 30% formulation, it was observed that one Yellow Rice Stem Borer was found dead. In conclusion, there is a significant difference on the pesticidal property of the three different formulations of Bakya pesticides, i.e., 10%, 20%, and 30%. It implied that a farmer should use 30% formulation of Bakya pesticide in order to control the population of the Yellow Rice Stem Borers.*

## Introduction

Rice is one of the main agricultural crops in the Philippines and it is the main source of food for Filipinos. It is also easy to cultivate in tropical and warm regions. One of the problems however, in rice plantation was the presence of pests, e.g., Yellow Rice Stem Borer*(Scirpophaga incertulas)*, during growth and development.

It is pointed out in one of the articles of Greenfields Magazine (2003) that one of the most disturbing problems in rice production is the farmer's continuous dependence on chemical–based pesticides/ insecticides in order to eradicate rice pests. The use of chemical–based pesticide is harmful to the environment and can affect soil productivity. At present, farmers have been diverting their interest in using natural product–based pesticides or at least a combination of chemical–based and natural product in farming to lessen the harmful effects of chemical–based pesticides to the rice crops and human health.

It is also mentioned in the 20th series of the Philippine Technology Bulletin (1999) that among the different kinds of pests existing in Philippine Farms, Dilaw na Askip, better known as Yellow Rice Stem Borers and scientifically labelled *Scirpophagaincertulas*is as the most common. It is a dangerous pest in most of the rice ecosystem in the country, especially in deep water rice. It is also commonly seen in aquatic environments where there is nonstop flooding. The domination of the rice stem borers in the rice fields can cause deterioration of the plant.

This study would like to formulate a pesticide from Bakya (*Dieffenbachia amoena*) plant to get rid of using chemical-based pesticides. This natural pesticide can be utilized to control the population of rice field pests, i.e., Yellow Rice Stem Borers (*Scirpophagaincertulas)*.

The results of this study can be a help to Filipino farmers. Thus, study tries to determine the pesticidal property of Bakya (*Dieffenbachia amoena*) leaf extract against Yellow Rice Stem Borer (*Scirpophagaincertulas)*.

According to Jones (1974) the desirable properties of pesticides include: (1) high toxicity to the pest controlled; (2) low toxicity to plants; (3) low toxicity to Humansand warm – blooded animals; and (4) does not form residue.

## Purpose of the Research

What is the pesticidal property of Bakya *(Dieffenbachia amoena)*against Yellow Rice Stem Borer *(Scirpophaga incertulas)*?

## Literature Review

Bakya or scientifically labelled as *Dieffenbachia amoena* is native to tropical America and West Indies, especially Costa Rica and Colombia (Abdurrahman-Ayvaz et

al., 2010). At present, *Dieffenbachia amoena* can be found in the Philippines and other tropical and subtropical climates. In the Philippines, *Dieffenbachia amoena* can be propagated by tissue culture, i.e., in vitro propagation approach, hence the plant *Dieffenbachia amoena* is abundant and easy to propagate and cultivate (Dafalla 2013). The parts of *Dieffenbachia amoena* plant, i.e., leaves and stem, contained phytochemicals, i.e, alkaloids, saponins, phenols, flavonoids, and resins. The *Dieffenbachia amoena* extract showed toxicity against brine shrimp (Oleyede, Onocha, & Abimbade, 2012).

Toxicity of plant extract can be tested by using animals, insects, and pests. The present study utilized pest, specifically the Yellow Rice Stem Borer *Scirpophaga incertulas* to test the toxicity of Bakya. Nowadays, many rice farmers used synthetic chemical pesticides in order to control the population of rice pests. Pyridalyl and indoxacarb were tested to pests and found to be effective (Shimokawato, 2011). Other synthetic chemical pesticides, i.e., etoxazole and fenazaquin, were tested to pests and showed to be effective in controlling the population of the pests (Natsuhara & Tanaka, 2012). The Avermectin-grafted-N,O-carboxymethyl chitosan (NOCC) determined its insecticidal activity and showed to be effective in controlling the insect population (Li et al., 2016). The foregoing studies provided effective method in insect pest management and showed excellent results in controlling the insect population, hence target vectors are easily destroyed. However, the availability of synthetic chemical pesticides has been declining for the past 60 years and as a result, many insects became resistant to synthetic chemical pesticides. Likewise, the use of synthetic chemical pesticides has contributed in the environmental problems, i.e., air, land, and water, (Manahan, 2000). The synthetic chemical pesticides were also considered organic toxic compounds which can cause environmental problems such as air, water, and land pollution (Baird & Cann, 2012). Most of the countries have signed the agreement in the Kyoto protocol which agreed to reduce the use of chemical pesticides. Indeed, chemical pesticides are threats to the environment and to the living organisms.

In the present study, the physical and chemical properties of Bakya (Dieffenbachia amoena) leaf extract were determined, and the pesticidal property of the crude extract was tested against Yellow Rice Stem Borer. No testing has been reported previously concerning the pesticidal property of the Bakya crude extract against the said pest. The leaf extract was used in the formulation of natural-product based pesticide.

## Methodology

*Research Design*

Firstly, Bakya leaves were collected and prepared. Then, Bakya leaves were extracted using ethyl alcohol (95%). Thirdly, Bakya pesticide was formulated and prepared. Fourthly, the physical and chemical properties of Bakya pesticide were determined. Lastly, toxicity test of Bakya pesticide against Yellow Rice Stem Borer was administered. *See Figure 1*

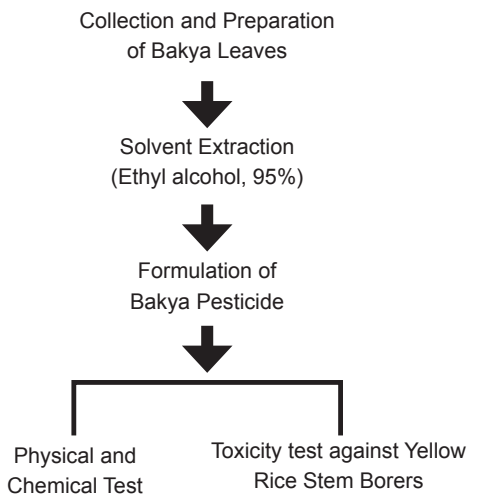



*Figure 1. Experimental Design*

*Procedure*

*Chemicals / Reagents and Apparatus*

**Table 1**

*List of Chemicals/ Reagents and Apparatus Used in this Study*

| Chemicals/ Reagents | Apparatus | |
|---|---|---|
| Acetic acid, $CH_3COOH$ | Analytical Balance | Ostwald Type Capillary Viscometer |
| Acetic anhydride, $CH_3COOCOCH_3$ | Beaker | PASport Chemistry Multi-Measure Sensor |
| Bakya extract | Burette | pH sensor |
| Benzene, $C_6H_6$ | Capillary Tube | Pycnometer |
| Chloroform, $CHCl_3$ | Colorimeter | SPARK software/ application |
| Crystal violet indicator | Condenser | Test tube |
| Distilled water | Cuvette | Volumetric Flask |
| Hydrochloric acid, HCl | Distillation Flask | |
| Perchloric acid, $HClO_4$ | Erlenmeyer Flask | |
| Saturated Sodium chloride, NaCl | Laboratory Thermometer | |
| Sodium bicarbonate, $NaHCO_3$ | Medicine Dropper | |
| Sodium hydroxide, NaOH | | |
| Water | | |

*Collection and preparation of raw materials*

Bakya leaves were collected at Sta. Cruz, Antipolo City and were authenticated by the National Museum, Botany Department in Taft, Manila City. The collected Bakya leaves were washed with tap water and rinsed with distilled water. The plant samples were sun-dried for 168 hours.

*Extraction of Bakya leaves*

Approximately, 100g of dried Bakya Leaves were weighed using the analytical balance, the leaves were then cut into smaller pieces. The small pieces of Bakya leaves were soaked in 1000ml of 95 % ethyl alcohol. The mixture was set aside for 24 hours. After soaking, the soaked small pieces of leaves were water bathed for 30 minutes at 95 $^0$C to remove the alcohol. The mixture was filtered using a filter paper in a funnel. The filtrate served as the concentrated crude extract.

*Formulation of Bakya Pesticide*

Three concentrations of Bakya pesticide were prepared, i.e., 10%, 20%, 30%, of the aqueous crude extract. Distilled water was used in preparing all concentrations. The 10% was prepared by dissolving 10.0 g of crude extract in 90.0 mL of distilled water. The 20% was prepared by dissolving 20.0 g crude extract in 80.0 mL of distilled water. The 30% was prepared by dissolving 30.0 g crude extract in 70.0 mL of distilled water.

*Determination of the Physical Properties*

1. Odor

Organoleptic test was used to determine the odor of the Bakya and Malathion pesticides. USP (2012).

2. Color

SPARK Colorimeter was used to get the color spectrum of the Bakya and Malathion pesticides. SPARK Colorimeter Manual.

3. Specific Gravity

Pycnometer was used to measure the specific gravity at different temperatures, i.e. 20 $^0$C, 25 $^0$C, of Bakya and Malathion pesticides. AOAC (1999).

4. Viscosity

Viscometer was used to determine the viscosity of Bakya and Malathion pesticides. AOAC (1999).

5. pH

The pH meter was used to measure the pH value of Bakya and Malathion pesticides. USP (2012).

*Determination of the Chemical Properties*

1. Solubility

The solubility of Bakya and Malathion pesticides were tested in the following substances: 1.5 M Sodium hydroxide, NaOH, 0.6 M Sodium bicarbonate, $NaHCO_3$, 1.5 M Hydrochloric acid, HCl, and concentrated Sulfuric acid, $H_2SO_4$. The ratio used was 1:1. USP (2012).

2. Alkaloids

Accurately weigh 2.5 g finely ground Bakya leaves into 250 mL Erlenmeyer. Add 15 mL 5% Acetic acid, $CH_3COOH$, and swirl until Bakya leaves is thoroughly wetted. Pipet 100 mL benzene-chloroform solution into flask and then 10 mL 36% NaOH solution. Stopper flask tightly and shake 20 minutes, using wrist-action shaker. Add 4.5 – 5 g (2 teaspoonfuls) Filter-Cel, mix, and filter most of benzene layer through Whatman No 2 paper into second flask. If filtrate has any turbidity, add 2 – 2.5 g (1 teaspoonful) additional Filter-Cel and refilter through Whatman No. 2 paper. Filtrate must be clear.

Pipet 25 mL aliquots of filtrate into each of two 125 mL Erlenmeyer. Pass stream of air over surface of solution in first flask 5 min, add 3 drops indicator, and titrate to green end point with 0.025*N* $HClO_4$, Add 1.0 mL acetic anhydride to second and let stand 15 min, add 25 mL $CH_3COOH$ and 2 drops indicator and titrate to blue-green end point with 0.025*N* $HClO_4$. Calculate % Alkaloids as follows: % Total Alkaloids = $V_1$ x *N* x 32.45/ weight sample; where $V_1$ = volume titrant for nonacetylated aliquot; and *N* = normality $HClO_4$ AOAC (1999).

*Toxicity Test: Median Lethal Dose (LD50) by single dose method*

All Yellow Rice Stem Borers were fasted from food and water for 16 hours prior to the tests but were given free access to food and water 12 hours after administration of the Bakya and Malathion pesticides. Two hours after administration, food, water, and *ad libitum* may be given also.

The maximum volume to administer of the pesticides, i.e., Bakya, Malathion, and the negative control (Ethyl alcohol solution) should not exceed 1 mL.

The researchers prepared five set–ups, *see Figure 3a*, for the Ethyl alcohol solution, Malathion, 10%, 20% and 30% Bakya pesticide. Each set–up contains a pot with rice plants planted on it, each of them also have a protective container made with plastic and cheap board. The dimension of the container is 24 inches for the height and 12 inches for the width, *see Figure 3b*. A hole was punched in each of the boxes with nets attached to it. Ten yellow rice stem borers were placed in each of the set –up.

Insecticide treatments were sprayed separately in each set–up with the use of sprayer, covering the whole plant, and the treatment was administered three times, with 3 hours interval in first and second administration and 12 hours interval between second and third administration. (Guevara, 2005).

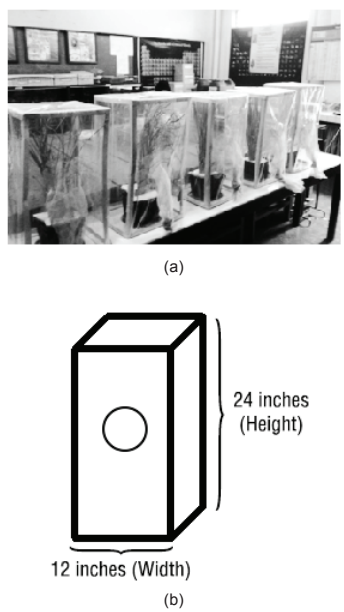



*Figure 3: a. Toxicity Test Set-up. b. Container Dimension*

**Table 2**
*Transmittance of Bakya and Malathion pesticides*

| | BAKYA PESTICIDE TRANSMITTANCE (%) | | | | MALATHION TRANSMITTANCE (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | **RED** | **GREEN** | **BLUE** | **ORANGE** | **RED** | **GREEN** | **BLUE** | **ORANGE** |
| 1 | 13.2 % | 21.00 % | 0.300 % | 20.40 % | 2.60 % | 1.700 % | 2.300% | 2.800 % |
| 2 | 13.2 % | 21.00 % | 0.200 % | 20.40 % | 2.90 % | 1.900 % | 2.500 % | 3.000 % |
| 3 | 13.1 % | 20.70 % | 0.3000 % | 20.30 % | 3.10 % | 2.000 % | 2.800 % | 3.400 % |
| **MEAN** | 13.17 % | 20.90 % | 0.270 % | 20.37 % | 2.870 % | 1.870 % | 2.530 % | 3.067 % |

*Data Collection and Analysis*

Three trials were done to test each of the physical and chemical properties of the Bakya Pesticide and Malathion. The Researchers compared the result of each trial using statistical treatment. For the $LD_{50}$, they took eighteen hours of caring, maintaining, and observing the rice plant samples. They counted the number of dead yellow rice stem borers and recorded it.

## Results and Discussion

*Method used to produce pesticide from Bakya Dieffenbachia amoena Bull leaves*

Solvent extraction method was used. The researchers used Ethyl alcohol (95%) as solvent. The Bakya crude extract was obtained from the solvent extraction and it was mixed with distilled water in three different concentrations, i.e., 10%, 20%, 30%.

*Physical properties of Bakya Dieffenbachia amoena Bull pesticide and Malathion*

1. Odor

The odor of Bakya leaves extract emitted a pungent odor. It has a bad smell, but not too strong. Malathion, on the other hand, exhibited a garlic odor.

2. Color

Table 2 shows the Transmittance of Bakya and Malathion pesticides. It also shows that the dominant color of Bakya pesticide is green while Malathion is orange with mean transmittance of 20.90% and 3.067%, respectively.

A pesticide's color can be different from each other but most of the time they are colourless. The color of the pesticide doesn't necessarily affect its toxicity. (Zacharia, 2011).

3. Viscosity, Specific gravity and pH

It can be seen in table 3 the viscosity, specific gravity, i.e., 20 °C, 25 °C, and pH of Bakya pesticide and Malathion in three trials. Table 3 revealed that the former exhibits means of 3.33, 0.845, 0.844, and 6.667, respectively, while the latter showed means of 7.10 s, 1.045, 1.048, and 0.7733, respectively. This implies that in terms of viscosity, specific gravity, and pH; Malathion is more viscous than Bakya pesticide, Malathion is heavier than Bakya pesticide, and Malathion is acidic than Bakya pesticide, respectively.

When it comes to viscosity, the higher the viscosity of a liquid, the more difficult it becomes to move it through a nozzle (during application) to produce small droplets. Generally, spraying a viscous liquid results in an uneven spray pattern or, in some instances, no spray pattern at all. (Pest

**Table 3**

*Viscosity, Specific gravity and pH of Bakya pesticide and Malathion*

| No. of Trials | Bakya Pesticide | | | | Malathion | | | |
|---|---|---|---|---|---|---|---|---|
| | Viscosity | Specific gravity | | pH | Viscosity | Specific gravity | | pH |
| | | 20°C | 25°C | | | 20°C | 25°C | |
| 1 | 3.43 s | 0.856 | 0.855 | 6.66 | 7.05 s | 1.051 | 1.051 | 0.87 |
| 2 | 3.36 s | 0.844 | 0.844 | 6.67 | 7.04 s | 1.042 | 1.051 | 0.76 |
| 3 | 3.21 s | 0.836 | 0.834 | 6.67 | 7.20 s | 1.042 | 1.042 | 0.69 |
| Mean | 3.33 s | 0.845 | 0.844 | 6.67 | 7.10 | 1.045 | 1.048 | 0.7733 |

Control Technology Magazine 2010) In that case, Bakya pesticide isideal to be applied using a nozzle to produce small droplets (spraying) since it exhibits lower viscosity than Malathion.

The specific gravity of most pest control pesticides must be similar to that of water so that there will be no difficulties in mixing it with liquid (Pest Control technology Magazine, 2010). *Bakya pesticide has a lower specific gravity making it easier to combine with liquids compared to Malathion.*

Soil has a slight negative charge (acidic) so it tends to absorb positively charged to uncharged chemicals. Pesticides that are acidic will tend to be absorbed by the soil rather than basic pesticides. Although acidic pesticides can eliminate pests, it can also damage the soil Jinde (1994). If a slightly acidic pesticide is applied to a basic (alkaline) surface, the pesticide may break down rapidly. Since Bakya pesticide is less acidic, then it has less tendency to damage the soil.

*Chemical properties of Bakya Dieffenbachia amoena Bull, pesticide and malathion*

1. Solubility

Bakya pesticide is soluble in water, indicating that it has the presence of polar group. It is also soluble in HCl, it exhibits a great potential of toxicity but is insoluble in NaOH, sulfuric acid, and hence it does not contains either phenol or carboxylic group. Malathion is insoluble in all solvents.

2. Alkaloids

**Table 4**

*Alkaloid Content of Bakya pesticide and Malathion*

| No. of Trials | Bakya Pesticide | Malathion |
|---|---|---|
| 1 | 1.40 % | 3.80 % |
| 2 | 1.20 % | 3.80 % |
| 3 | 0.60 % | 7.40 % |
| Mean | 1.07 % | 5.00 % |

It can be seen in Table 4 that the alkaloid contents of Bakya leaves extract in three trials. The Bakya pesticide exhibit a mean of 1.07 % while the mean of Malathion is 5.00 %.

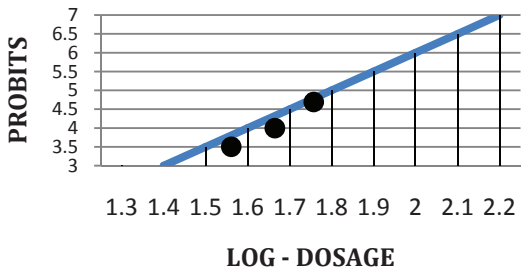
3. $LD_{50}$ of Bakya *Dieffenbachia amoena pesticide and Malathion*

**Table 5**

*Probits of Bakya pesticide and Malathion*

| Pesticide concentration | Dose mg/kg BW | Log Dose | No. of insects dead/ tested | Observed % dead | Empirical Probit |
|---|---|---|---|---|---|
| 10% Bakya | 15 mg | 1.8 | 0/10 | 0% | 0 |
| 20% Bakya | 15 mg | 1.8 | 0/10 | 0% | 0 |
| 30% Bakya | 15 mg | 1.8 | 1/10 | 25 % | 4.33 |
| Malathion | 15 mg | 1.8 | 2/10 | 13 % | 3.87 |
| 30% Ethyl alcohol soln. (negative control) | 15 mg | 1.8 | 0/10 | 0% | 0 |

The probits values are plotted against log-dose, and then the dose corresponding to probit 5, i.e., 50%, is found out.




**Log-$LD_{50}$ = 1.8**

*Figure 4. $LD_{50}$ of Bakya pesticide and Malathion.*

Figure 4 shows the graph for the $LD_{50}$of Bakya pesticide and Malathion. The LD value for the probits of 5 was obtained by linear regression and found at 1.8. Hence, $LD_{50}$value was equal to 63.10 mg/kg for both pesticides.

*Comparison between Bakya pesticide and Malathion*

1. Physical Test

**Table 6**

*Comparison of Bakya Pesticide and Malathion in terms of Physical Properties*

| | Bakya Pesticide | Malathion | Computed T – value |
|---|---|---|---|
| Viscosity | 3.33 s | 7.10 s | 24.47 |
| Specific Gravity | | | |
| 20° | 0.845 | 1.045 | 37.2478 |
| 25° | 0.844 | 1.048 | 29.5697 |
| pH | 0.7733 | 6.667 | 112.3 |

*Confidence level = 95%, Degree of freedom = 4*

In terms of the resistance of this pesticides to flow, the viscosity of Malathion is greater than that of Bakya pesticide which means that Malathion is more viscous than Bakya pesticide. The critical value of *t* at the 95% confidence level for 4 degree of freedom is 2.78. Since 24.47 > 2.780, we reject the null hypothesis at 95 % confidence level and conclude that there is a significant difference between Bakya pesticide and Malathion in terms of viscosity. The higher the viscosity of liquid, the more difficult it becomes to move it though a nozzle to produce small droplets.

It also showed the specific gravity of Bakya pesticide and Malathion in two temperatures which are 20°C and 25°C with three trials each. In 20°C, the mean of the specific gravity of Bakya leaves extract is 0.845 while of Malathion is 1.045. In 25°C, the mean of the specific gravity of Bakya pesticide is 0.844 while of Malathion is 1.048. The critical value of *t* at the 95% confidence level for degree of freedom is 2.78. Since all of the value of T–test in different temperatures, such as 37.2478 at 20°C, 29.5697 at 25°C, are all greater than 2.78, we reject the null hypothesis at 95% confidence level and conclude that there is a significant difference between Bakya pesticide and malathion in terms of specific gravity in different temperatures. Specific gravity may be understood in terms of weight of the liquid. Specific gravity of most pest control pesticides that is similar to that of water, making these liquids not difficult to mix.

It also confirmed that both Malathion and Bakya pesticide are acid solutions based on their pH levels, although Malathion is obviously more acidic as compared to the Bakya pesticide. The critical value of *t* at the 95% confidence level for degree of freedom is 2.78. Since the computed *t* value is less than 2.780, we reject the null hypothesis at 95 % confidence level and conclude that there is a significant difference between Bakya pesticide and Malathion in terms of pH level. If a slightly acidic pesticide is applied to a basic (alkaline) surface, the pesticide may break down rapidly.

2. Chemical Test

**Table 7**

*Comparison of Bakya Pesticide and Malathion in terms of Chemical Properties*

| | Bakya Pesticide | Malathion | Computed T – value |
|---|---|---|---|
| **Alkaloid** | 1.07% | 5.00 | 3.22 |

*Confidence level = 95%, Degree of freedom = 4*

This table shows that both pesticides contain alkaloid, though Malathion has

a greater content compared to that of Bakya pesticide. Alkaloids are nitrogenous compounds that show insecticidal properties even at low concentrations.

3. Toxicity Test

As shown in Figure 4, the $LD_{50}$value is equal to 63.10 mg/kg for both pesticides. $LD_{50}$ values are standard measurements; it is possible to compare relative toxicities among pesticides. The lower the $LD_{50}$ dose hence, the more toxic the pesticide.

## Conclusion & Recommendations

Based on the findings of the study, the following conclusions were drawn: 1) the researchers conclude that there is a significant difference between the commercial pesticide and *Bakya Dieffenbachia amoena*. pesticide in terms of their physical properties (viscosity, specific gravity and pH). The viscosity of Malathion is greater than that of Bakya pesticide which shows that Bakya pesticide is ideal to be applied using a nozzle to produce small droplets (spraying) since it exhibits lower viscosity than Malathion. The specific gravity of Bakya pesticide in different temperatures are all lower compared to Malathion which implicates that Bakya pesticide has a lower specific gravity making it easier to combine with liquids compared to Malathion. Both pesticides are both acidic but since Bakya pesticide is less acidic, then it has less tendency to damage the soil; 2) The researchers conclude that there is a significant difference between the commercial pesticide and *Bakya Dieffenbachia amoena*. pesticide in terms of their chemical properties (solubility and alkaloid content) Bakya pesticide is soluble in water, indicative that it has the presence of Polar Group, it is also soluble in HCI, it exhibits a great potential of toxicity but is insoluble in NaOH and $H_2SO_4$, hence it does not contain either Phenol or Carboxylic Group. Malathion is insoluble in all the compounds. Both pesticides contain alkaloid; 3.) The researchers conclude that there is a significant difference between the commercial pesticide and Bakya *Dieffenbachia amoena*pesticide in terms of their toxicity properties. The probits at 13% and at 25% is approximately 4. The LD value for the probit of 5 is 1.8 and $LD_{50}$ is equal to 63.10 mg/kg. There is a significant difference between the commercial pesticide and Bakya *Dieffenbachia amoena*pesticide; 4.) The computed $LD_{50}$ of Bakya Pesticide and Malathion is both 63.10 mg/kg which is closely with the Acute oral $LD_{50}$ (rat) which is equal to 72 mg/kg (Technical from Malathion MSDS); 5.) The findings showed that in using 10% and 20% formulations, there were no observable fatalities among the Yellow Rice Stem Borers. However, using 30% formulation, it was observed that one Yellow Rice Stem Borer was found dead. In conclusion, there is a significant difference on the pesticidal property of the three different formulations of Bakya pesticides, i.e., 10%, 20%, and 30%. It implied that a farmer should use 30% formulation of Bakya pesticide in order to control the population of the Yellow Rice Stem Borers.

The researchers recommend the following: 1) use Bakya pesticide as substitute for Malathion pesticide; 2) further study on the isolation, elucidation, and characterization of alkaloids from Bakya *Dieffenbachia amoena* leaves extract*;* 3) further study on the use of other solvent for extraction; 4) further study on the use of Bakya pesticide in other plant pests; 5) $LD_{50}$. Their toxicity should be tested on other rice pests.

■ ■ ■

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