

PAPER • OPEN ACCESS

The Reduction Of Armyworms On Mustard Greens Using The Extract Of Papaya Leaf And Kipahit Leaf

To cite this article: Ulina Karo-Karo *et al* 2022 *IOP Conf. Ser.: Earth Environ. Sci.* **1083** 012052

View the [article online](#) for updates and enhancements.

You may also like

- [GC-MS Analysis of Papaya Leaf Extract \(*Carica Papaya* L.\)](#)
Hussein Lafta Al-Seadi, Manal Zibari Sabti and Dhia Ahmad Taain
- [Bioenrichment of Papaya Leaf Meal \(*Carica papaya*\) with Different Feed Formulation to Increase Nile Tilapia \(*Oreochromis niloticus*\) Growth](#)
Ricky F Simanjuntak, Supardi Husni and Jimmy Cahyadi
- [The effect of papaya leaf meal on protein utilisation efficiency in broilers which affects the sustainability of poultry production](#)
R Christone, U Hasanah, A Sadeli et al.

The Reduction Of Armyworms On Mustard Greens Using The Extract Of Papaya Leaf And Kipahit Leaf

Ulina Karo-Karo*, Dameria Gultom, Rapael Ginting, Muhammad Aditya Kurnia, Mira Helia Cristy Pasaribu, Elisabet Siagian, Cronika H. Manurung

Department of Public Health, Universitas Prima Indonesia, Medan, Indonesia

Email: ulinakarokaro@unprimdn.ac.id, dameriagultom46@gmail.com, rafaelsingting@unprimdn.ac.id, adityakurnia000@gmail.com, miraheliacristypass1000@gmail.com, elisabetsiagian700@gmail.com, cronikamanurung094@gmail.com

Abstract.. Papaya leaf contains an active substances, i.e. papain that can control worm and pest effectively. It also can be contact poison for pest. This research aims to know the reduction of armyworms (Spodoptera) on mustard greens (Brassica juncea) by giving the extract of papaya leaf (*Carica papaya* L.) and kipahit leaf (*Tithonia diversifolia*) to prevent chemical pest poisoning on farmers. This is an experimental research with The Only Controlled Group design. Statistic test for this research is Anova test with 95% confidence interval and significance value $0,007 < 0,05$. The conclusion of this research is there is papaya leaf extract can reduce Spodoptera effectively. Meanwhile, kipahit leaf extract cannot reduce Spodoptera effectively, with 0,068 significance value.

Keywords; *Papaya Leaf, Kipahit Leaf, Armyworms*

1. Introduction

The excessive use of chemical pesticides could cause poisoning through inhalation and contaminated foods [1]. According on World Health Organization (WHO), pesticides are toxic substance, but on the other hand pesticides are useful to protect plants [2]. Farmers who did not wear Personal Protective Equipment (PPE) during mixing or spraying pesticides could experience health problems. There are four common problems caused by it, i.e. headache, increase of fatigue, itchy, and nausea [3]. Until nowadays, damage caused by pest in farm land has been a serious problem in agriculture. Farmers assumed that chemical pesticides could handle pest effectively and practically. In agricultural, there are kind of pesticides that known as effective weapons to exterminate pest, e.g. herbicide, insecticide, and fungicide [4].

In Indonesia, farmers tend not to pay attention to the importance of Personal Protective Equipment (PPE) when they using chemical pesticides. It could cause poisoned risk as the effect of chemical pesticides exposure [5]. Based on the data by WHO, 1.5 million pesticides harm happened on agriculture sector. In developing countries, it reached 20.000 cases, especially Indonesia with 771 cases. Chemical pesticides incidence could happen because of the lack of farmers's knowledge about the harm of chemical pesticides. [6]. Therefore, natural pesticide from plants are needed in which do not give negative effect toward health, and environmentally safe, e.g. papaya leaf and kipahit leaf extract [2]. Natural pesticide from traditional plants, e.g. papaya leaf that contains active papain substance to control worm and pest has been known in agricultural since before the release of chemical pesticide [7].



Papaya leaf contains chemical e.g. papain, alkaloids, pseudoscorpiones, flavonoid, and saponin. Papain is a/an substance of enzyme that could extracted from papaya plant latex. Saponins and alkaloids are stomach poisoning. If saponins and alkaloids enter the insects' body, their digestion will be disturbed. Alkaloids also could prevent the growth of insects, especially three main hormones in insects, i.e. brain hormone, edixone hormone, and juvenile hormone. The effect of undeveloped hormones could cause failure of metamorphosis. Flavonoid is a chemical substance in papaya leaf that work as strong respiration inhibitor or as respiration poison. Flavonoid works by entering worm's body through respiration, then it cause decrease of nerve function, harm the respiration system, and cause the insect could not breathe and then die [8]. Papaya latex also produce chemical substances that could kill nuisance organism. Papaya latex has the ability to protect plants from nuisance organism, e.g. as food repellent, contact poison, and disturb the physiology function of insect. It affects the insect through senses. Since the insect repellent the food, their growth is hampered like the change from one instar to next instar, from instar to pupa, and even cause death [8].

According to past research, papaya latex contains a group of protease system enzyme, e.g. 10% papain, 45% chymopapain, and 20% lysozyme. The function of chymopapain enzyme is catalyst in hydrolysis reaction between protein and polypeptide. Meanwhile, the lysozyme enzyme as anti-bacterial and works by breaking the cells bacterial [9]. Papaya leaf contain 35 mg/ 100mg of tocophenol. It also contains alkaloid and papain enzyme. These enzymes are identic with white thick latex. The function of these enzymes are to break enzymes because of proteolytic. Papaya leaf is known in saving lots of benefits and it contain anti-microbes. Papaya leaf also has toxication [10]. Papaya leaf extract contains folic acid, B12, A and C, alkaloids, saponins, glycosides, tannins and flavonoids [11]. One of the alternative to prevent pest safely for human and environment is by doing a biological control technique which is known as biopesticides that utilizes natural substances and available in nature. In Indonesia, biopesticides is still less popular and not many farmers use it as pesticides[12]. The use of papaya and kipahit plants as pest control is not much done by farmers. In this research, researchers try to use papaya leaf and kipahit leaf to control worm pest that harm mustard greens by extracting the papaya leaf and kipahit leaf. Natural pesticides by the extract of papaya leaf and kipahit leaf are expected to reduce the worm pest on mustard greens plant with safe for human and environmental.

2. Research Method

2.1. Location of Research

This research was done in Lumban Holbung Village, Uluan District, Toba Samosir Regency.

2.2. Research of Materials and Tools

Materials used in this research are mustard greens seeds, papaya leaf, and kipahit leaf. Tools used in this research are knife, scale, blender, pen, ruler, cloth, small bottle, spray bottle, jar, rubber, and book. This research has 90 samples of armyworms which divide in two groups of treatment, in which every treatment will be given three concentrate with three times repetition in every treatment.

2.3. Sample Identification and Extraction

This research used young and old papaya leaf, and kipahit leaf that has been separated from its stem. The solution of papaya leaf and kipahit leaf is made by taking some leaf from the field. Then, the leaves were washed with clean water. Next, the papaya leaf and kipahit leaf weighed 200 grams, 400 grams, and 600 grams using scale. The leaves were put in each treatment, and soaked into ½ litres of celan water. The materials were cut in small pieces and blend it until soft, then each papaya leaf and kipahit leaf were soaked in 600 mL of clean water for 24 hours. Then the soaked leaves were filtered by soft cloth to produce 100% of extract.

Preparation to make extracts:

- 200 grams of papaya leaf soaked into ½ litres of clean water
- 400 grams of papaya leaf soaked into ½ litres of clean water

- 600 grams of papaya leaf soaked into ½ litres of clean water
- 200 grams of kipahit leaf soaked into ½ litres of clean water
- 400 grams of papaya leaf soaked into ½ litres of clean water
- 600 grams of papaya leaf soaked into ½ litres of clean water

The application of papaya leaf and kipahit leaf extract were done by spraying directly to the armyworms with small spraying bottle. After that, the spraying jars were closed by thin plastics. Each jars include five armyworms. The observation was done in three days to know the effectivity of papaya leaf and kipahit leaf extract.

2.4. Mortality Percentage Calculation Armyworms

The armyworms mortality percentage were calculated with the formula:

$$\text{Mortality} = \frac{A}{B} \times 100\%$$

Explanation

A = Numbers of dead armyworms

B = Numbers of alive armyworms [13]

2.5 Data Analysis

Anova test with 95% of confidence interval by SPSS program were done to know the effectivity of papaya leaf and kipahit leaf extract. If the statistic test shown the effectivity of papaya leaf and kipahit leaf extract treatment toward the reduction of armyworms on mustard greens, then Post Hoc Test will not be done. Meanwhile, if the statistic test did not show the effectivity of papaya leaf and kipahit leaf extract treatment, then Post Hoc Test must be done.

3. Result and Discussion

3.1. Determinant of Papaya Leaf

The taxonomy of papaya plant was identified in Lumban Holbung Village, Uluan District, Toba Samosir Regency, i.e. [14]:

Domain	: Flower plant
Kingdom	: Plantae
Subkingdom	: Tracheobionta
Class	: Magnoliopsida
Subclass	: Dilleniidae
Super division	: Spermatophyta
Infra kingdom	: Steptophyta
Genus	: Carica
Species	: Carica papaya Linn

The extract of papaya leaf can also be used to cured thrombocytopenia caused by Dengue Hemorrhagic Fever. Papaya leaf contain few secondary metabolites, e.g. flavonoid and tannin [15].

3.2. Determinant of Kipahit Leaf

The classification of kipahit plant are i.e. [16]:

Division	: Spematophyta
Subdivision	: Angiospermae
Class	: Dicotyledonae
Ordo	: Asterales
Family	: Asteracea
Genus	: Tithonia
Species	: Tithonia diversifolia

3.3. The Result of Papaya Leaf Extract Effectiveness Toward Armyworms Mortality on Mustard

Table 1. Average of Armyworms Mortality

Treatment	Average of Armyworms Mortality (%)	Information
P1	46,6*	Papaya leaf extract 200 %
P2	66,6	Papaya leaf extract 400 %
P3	93,3**	Papaya leaf extract 600%

^aPapaya leaf extract treatment (Table armyworm presentation)

Explanations:

*: The lowest result of armyworms mortality with natural pesticides of 200% of papaya leaf extract treatment (P1).

**: The highest result of armyworms mortality with natural pesticides of 600% of papaya leaf extract treatment (P3).

According to table 1, it is shown that armyworms mortality increase as the concentration increase.

3.4. The Result of Kipahit Leaf Extract Effectiveness Toward Armyworms Mortality on Mustard Gren

Table 2. Average Of Armyworms Mortality

Treatment	Average of Armyworms Mortality (%)	Information
P1	46,6*	Papaya leaf extract 200 %
P2	66,6	Papaya leaf extract 400 %
P3	93,3**	Papaya leaf extract 600%

^bPapaya leaf extract treatment (Table armyworm presentation)

Explanations:

*: The lowest result of armyworms mortality with natural pesticides of 200% of kipahit leaf extract treatment (P1)

**: The highest result of armyworms mortality with natural pesticides of 600% of papaya leaf extract treatment (P3).

According to the result, test of armyworms mortality with natural pesticides of papaya leaf and kipahit leaf extract shown a significant effect. The lowest average percentage of natural pesticides treatment of papaya leaf extract is 46,6%. The lowest average percentage of natural pesticides treatment of kipahit leaf is 26,6%. The highest result of natural pesticides treatment of papaya leaf extract is 93,3%. The highest result of natural pesticides treatment of kipahit leaf extract is 53,3%. The armyworms mortality comparison with the extract of papaya leaf and kipahit leaf are shown below.

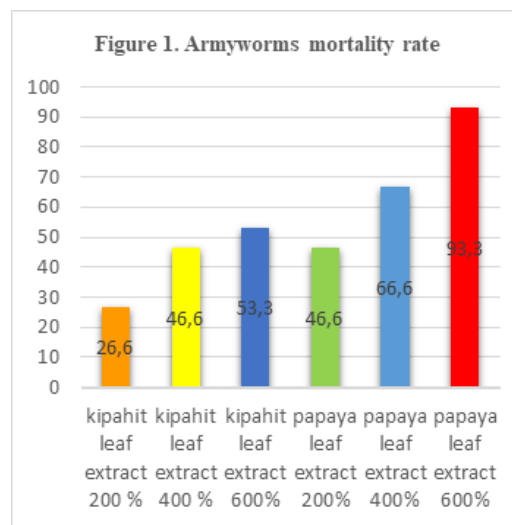


Figure 1. Armyworms mortality rate

The highest mortality rate of armyworms is 600% concentration of papaya leaf extract i.e. 93,3% with total 14 dead armyworms. Total of dead armyworms from 200%, 400%, and 600% concentrations are 31. Meanwhile, the lowest mortality rate of armyworms is 200% concentration of kipahit leaf i.e. 26,6% with total 4 dead armyworms. Total of dead armyworms from 200%, 400%, and 600% concentrations are 19. Anova test to compare the effectiveness of papaya leaf and kipahit leaf extract.

Table 3. Average of Armyworms Mortality

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.889	2	1.444	4.333	.068
Within Groups	2.000	6	.333		
Total	4.889	8			
Between Groups	8.222	2	4.111	12.333	.007
Within Groups	2.000	6	.333		
Total	10.222	8			



(a)



(b)

According to the result, there is effectivity of papaya leaf extract with 600% of concentration to reduce the armyworms. This has the same result by [17] which state Anova test shown there is an effect of papaya leaf solution with 100% concentration toward tritip worm, caterpillar, crop, and

armyworms on mustard greens plants. It is the best way to push the attack of worm pest on Bina Putra Street, Buntung Payung, Landasan Ulin District, Banjarbaru City. Papaya leaf solution with 100% concentration was classified as strong solution which able to kill 25 armyworms.

It is caused by secondary metabolite chemicals substances that killed armyworms effectively with the help of papain and kimopapain enzyme. It was explained by [18], i.e. papain and kimopapain enzyme that contained in papaya leaf could be a contact poison for pest. Enzyme entered from natural holes of pest body, and papaya leaf extract could spread throughout body so it could distract eating activity of armyworms. Moreover, papain enzyme could affect physiological of armyworms pest.

4. Conclusion

According to the result, there is an effectivity of papaya leaf extract to reduce armyworms on mustard greens to prevent chemical pesticides poisoning for farmers in Lumban Holbung Village, Uluan District, Toba Samosir Regency with highest result of natural pesticides treatment of papaya leaf extract is 93,3% with 600% concentration and highest result of natural pesticides treatment of kipahit leaf extract is 53,3% with 600% concentration.

According to Anova test, significance value is $0,007 < 0,05$; it means H_0 rejected. It means there is an effectivity of papaya leaf extract as natural pesticides to reduce armyworms to prevent chemicals poisoning for farmers. Meanwhile, Anova test for kipahit leaf extract with significance value $0,068 > 0,05$; it means H_0 accepted. It means there is no effectivity of kipahit leaf extract as natural pesticides to reduce armyworms to prevent chemicals poisoning for farmers.

Acknowledgement

We sincerely thank Prima Indonesia University, Head of Village in Holbung Village, and also villagers in Holbung Village who support us to finish this research.

References

- [1] Kafle S, Vaidya A, Pradhan B, Jørs E and Onta S 2021 Int. J. Environ. Res. Public Health Factors associated with practice of chemical pesticide use and acute poisoning experienced by farmers in Chitwan district, Nepal **vol. 18, no. 8** doi: 10.3390/ijerph18084194
- [2] Irmawati 2018 Public Health Journal Public Health Journal J-Kesmas **vol. 4, no. 1, pp. 43–47**
- [3] As'ady B A, Supangat S and Indreswari L 2019 J. Agromedicine Med. Sci Analysis of Personal Protective Equipments Pesticides Usage Effects on Health Complaints of Farmers in Pringgondani Village Sumberjambe District Jember Regency **vol. 5, no. 1, p. 31, doi: 10.19184/ams.v5i1.7901**
- [4] Şenocak G, 2019 The influence of organic pesticides of the Mindi leaves (*Melia Azedarach* L.), Papaya leaf (*Carica Papaya* L.), and pair of papaya (*Carica papaya* L.) and Mindi Leaf (*Melia azedarach* L.) to pests and red chili crops (*Capsicum annum* L.) doi: 10.1017/CBO9781107415324.004
- [5] Joko T, Dewanti N A Y and Dangiran H L, 2020 J. Environ. Public Health Pesticide Poisoning and the Use of Personal Protective Equipment (PPE) in Indonesian Farmers **vol., 2020, doi: 10.1155/2020/5379619**
- [6] Vutrianingsih N E, Zulfa I and Mukono J 2020 Indones. J. Public Heal Risk Factors Related To Karbamat Pesticide Poisoning and Organophosphate in Rice Farmers in Masangan Village Kulon Kabupaten Sidoarjo **vol. 15, no. 2, p. 190, , doi: 10.20473/ijph.v15i2.2020.190-200**
- [7] Suparti S and Setiani O 2016 J. Pena Med Some of the risk factors that affect the incidence of Pesticide poisoning on farmers **vol. 6, no. 2, pp. 125–138**
- [8] Devi S 2018 Effectiveness of Papaya Leaf Extract (*Carica Papaya* L.) and Soursak Leaf (*Annona Muricita*) on the intensity of the litura spodoptera pest attack. And the result of lettuce plants, no. April.
- [9] Sari D, Santoso L and Madang K 2016 j. Biool Learn The influence of Papaya Leaf Extract (*Carica Papaya* L.) on the sedation effect on mice (*Mus musculus* L.) and his donations on the teaching of high school biology, Rev. Bio;. his Learn. **vol. 3, no. 2, pp. 183–189, doi: 10.36706/fpbio.v3i2.4692**
- [10] Ramadhona R, Djamilah D and Mukhtasar M 2018 J. Sci. Bent The effectiveness of papaya leaf extracts in leaf tree controls on the vegetable phase of the eggplant **vol. 20, no. 1, pp. 1–6, , doi: 10.31186/jipi.20.1.1-6**

- [11] Snigdha S, Ravish M, Narayan G, Manisha N, Nilotpol K and Kishore D, 2019 EC Dent. Sci Phytochemical Analysis of Papaya Leaf Extract: Screening Test, **vol. 18, no. 3, pp. 485–490**
- [12] Amalia A V and Yusa M H 2018 Journal of Education IPA indonesian In Delima Rose Apples USING Soursop Leaf Extract (*Annona muricata*) **vol. 7, no. 1, pp. 1–8, doi: 10.15294/jpii.v7i1.12484**
- [13] Sapietro T S, Hasibuan R, Hariri A M and Wibowo L 2019 Kipahit leaf potency tets (*Tithonia diversifolia* A. Gray) As a botanical insecticide *Spodoptera litura* F. In laboratory, J. Agrotek Trop **vol. 7, no. 2, p. 371, , doi: 10.23960/jat.v7i2.3260**
- [14] Yogiraj V, Goyal P K and Chauhan C S, 2015 *Carica papaya* Linn : An Overview **vol. 2, no. 5, pp. 1–8**
- [15] Journal I, Yudha S, Utama A and Ata U A, 2018 The effect of papaya leaf extract (*Carica papaya* l .) To the bleeding time on mice with trombositopenia,.
- [16] Ayu S and Lestari D 2016 The of the paitan (*Tithonia diversifolia*) as an organic fertilizer in soybean plants, Sched. plantong. food **vol. 11, no. 1, pp. 49–56**
- [17] Barreto M 2017 The persecution powers using papaya leaf section in the increase in the production of the prison (*Brassica Juncea* (*Brassica Juncea* L.) **vol. 42, no. 2014, pp. 1–14**
- [18] Mawuntu M S C 2016 The Effectiveness of soursop leaf extract and papaya leaf *Plutella xylostella* L. (Lepidoptera; Yponomeutidae) In cabbage plants in plants in Tomohon City, J. lscientific Sci. **vol. 16, no. 1, p. 24, doi: 10.35799/jis.16.1.2016.12468**