Global Journal of Agricultural Research
Vol.6, No.1, pp.1-8, January 2018
Published by European Centre for Research Training and Development UK (www.eajournals.org)

# CONTROLLING OF FIRE WORM IN OIL PALM BY THE TREATMENT OF BIOPESTICIDES IN THE LABORATORY

**Sri Ngapiyatun, N. Hidayat, and F. Mulyadi**

State Agricultural Polytechnic of Samarinda, Jl. Samratulangi PO BOX 192 Samarinda

**ABSTRACT**: *Factor that reduces yield of oil palm cultivation is pest infestations, and one of them is fire worm. Objective of the research was to study the extraction technique and application of the best biopesticides in order to reduce palatability of fire worm in the laboratory. The research was conducted at three locations as follow, at laboratory where biopesticides were made and applied, at laboratory of protection where compounds in biopesticides were analyzed, and at oil palm plantation of Muara Badak, where samples of the fire worm and leaves of oil palm were taken. The research was conducted for 3 months, which included preparation of materials and equipments, production of biopesticide, application of biopesticide, and took the data. The research used Factorial Randomized Complete Design (RCD) by two factors. Factor A is solvent, which comprises of two factors, water solvent and methanol, while factor B is bioextract that comprises of six factors, such as the control (K0), soursop' seed extract (BS), soursop's leaves extract (DS) and citronella extract (S), pepper's seed extract (BL), and tobacco extract (T) along with 3 replications. Leaves were soaked into pesticide in accordance with the treatment, and then the leaves were applied to the fire worms for 7 days by putting leaves and the fire worms into stoppered glass jar, which was covered by muslin. The observed parameters include activity of the fire worms, the day when the fire worms die, and palatability of the fire worms. Results of the research showed that the best biopesticide, which could reduce palatability of the fire worm, is tobacco extract (T) and methanol as solvent that reach 100%, in which the fire worms avoided the tobacco-treated leaves and died within 2 hours following the application.*

**KEYWORDS**: Biopesticide, Palatability, Fire Worm, Oil Palm

## INTRODUCTION

Oil palm is commodity of plantation that plays important role for Indonesia due to it produces vegetable oil. However, like other plants, oil palm cultivation has faced obstacles that may decrease its productivity. One of them is pest infestation, such as fire worms.

Objective of the research was to determine the best extraction technique and types of biopesticide in order to decrease palatability of the fire worms at the laboratory. Then, the research has made biopesticide extract from several types of plants along with different treatments in order to overcome palatability of the fire worms, which mostly attack oil palm. Plants that are used in this research include seeds and leaves of soursop, citronella's leaves, tobacco's leaves, and pepper's seeds.

Maryani (1995) suggested that soursop's seeds contain bioactive acetogenin, which is considered as insecticidal and anti-feedant. Unripe fruit, seeds, leaves, and roots of soursop contain chemical compounds of annonain that plays as insecticide, larvacide, repellent, and anti-feedant, which work as contact poison and stomach poison (Kardinan, 2002).



ISSN 2053-5805(Print), ISSN 2053-5813(Online)

Citronella contains essential oil, which comprises of citral, citronella, geraniol, myrcena, nerol, farnesol, metal heptenone, and dipentene compounds. Mixture of citronella's leaf ashes may eradicate the warehouse's insects and inhibit the egg laying due to the ashes contain 49% silica ($SiO_2$) that will desiccate the insects, so that they will have dehydration.

Tobacco contains nicotine, however, high concentration of nicotine is found in branches and leaf veins. Tobacco is well-known as repellent, fungicide, and acarycide that work as contact poison, stomach, and respiration, as well as systemic properties. (Kardinan. A, 2000)

Pepper's seeds contain active materials, such as alkaloid, methylpyrroli, piperovatine, chavincine, piperidine, and piperine. In which the pepper's seeds can be used as insecticide, fungicide, and nematicide (Kardinan. A, 2000).

## METHOD OF THE RESEARCH

### Time and Location of the Research

The research was conducted at two different locations as follow, at laboratory of production, State Agricultural Polytechnics of Samarinda (producing biopesticide extract, breeding the fire worms, and biopesticide application in accordance with the treatment against the oil palm's leaves to feed the fire worms, and then the fire worms were put into container, which has been treated) and laboratory of protection, Department of Crop Plants (analyzing any poison contains in seeds and leaves of the soursop, citronella's leaves, tobacco's leaves, and pepper's seeds); and at oil palm plantation in Muara Badak, East Kutai Regency (taking the fire worms in order to test their palatabilities).

The research had been conducted for 3 months, which included preparation of materials and equipments, producing or making biopesticide, application of biopesticide, and taking the data.

### Materials and Equipments

Equipments of the research are beaker glass, calibrated beaker, plastic pot, plastic box, homogenizer (blender), centrifuge, freezer dryer, pipette, stationeries, and camera.

Materials of the research are 3-month oil palm, fire worms that derived from culturing in the laboratory, seeds and leaves of soursop, citronella's leaves, tobacco's leaves, pepper's seeds, papaya's leaves, NPK fertilizers (urea, TSP, and KCl), aquades, and methanol.

### Procedure of the Research

### 1. Design of the Research

This research would be conducted using factorial randomized complete design (RCD) by two factors. Factor A is types of solvent that comprises of two factors, such as water and methanol, while factor B is types of bioextract that comprises of six factors, such as: (1) extract of soursop's seeds (BS), (2) extract of soursop's leaves (DS), (3) extract of citronella's leaves (DR), (4) extract of pepper's seeds (BL), and (5) extract of tobacco's leaves (DT). The research was done by three replications.



ISSN 2053-5805(Print), ISSN 2053-5813(Online)

## 2. Ways of Making Biopesticide Extract

Ways of making biopesticide using methanol and water as solvents, as well as its application are given below:

a. Making biopesticide extract by methanol

25 g fresh organic materials are chopped, and extracted using 100 ml methanol and 20 ml liquid detergent for 15 minutes. Extraction is done using blender. And then, extraction products are centrifuged for 20 minutes at 3,000 rpm, after that they are evaporated using freezer dryer to reach the volume more or less than 1 ml, and then the solutions are diluted using aquades to reach concentration 5 %, and finally, the solutions is ready to be used for the treatment.

b. Making biopesticide extract by water

100 g fresh organic materials are chopped, and extracted using water by ratio 1 : 3, and then added with 20 ml liquid detergent. Extraction is done using homogenizer/blender for 15 minutes. The extraction products are leaved for 24 hours, and then strained using soft cloth and the solutions are ready to be used for the treatment.

## 3. Application of biopesticide extract

Three blades of 3-month oil palm's leaves are soaked in biopesticide extract in accordance with the treatment for 30 seconds. After that, the leaves are dry-aerated and weighed. Then, they are put into 14 cm x 14 cm x 5 cm plastic boxes. Moreover, the leaves are infested with a fire worm for each treatment, and the plastic boxes are covered and ventilated using muslin. In the following day, those leaves are weighed and substituted with the new ones, which had been weighed, and they are done continuously for 7 days after application (DAA). Each treatment has three replications.

## 4. The Observed Parameter

The observed parameter in this research is palatability of fire worms based on percentage of decrease on eating activity, weight of feed (oil palm's leaves), which has been eaten by the tested-insects during period 1-7 days after application (DAA).

Percentage of decrease on eating activity is calculated using the equation below (Prijono, 1988):

$$P = 1 - \left(\frac{T}{C}\right) X 100\%$$

Whereas :

P = percentage of decrease on eating activity

T = weight of eaten-feed from the treatment

C = weight of eaten-feed from the control

Procedures of research in the first year are presented clearly on flowchart in Figure 1 below :



ISSN 2053-5805(Print), ISSN 2053-5813(Online)

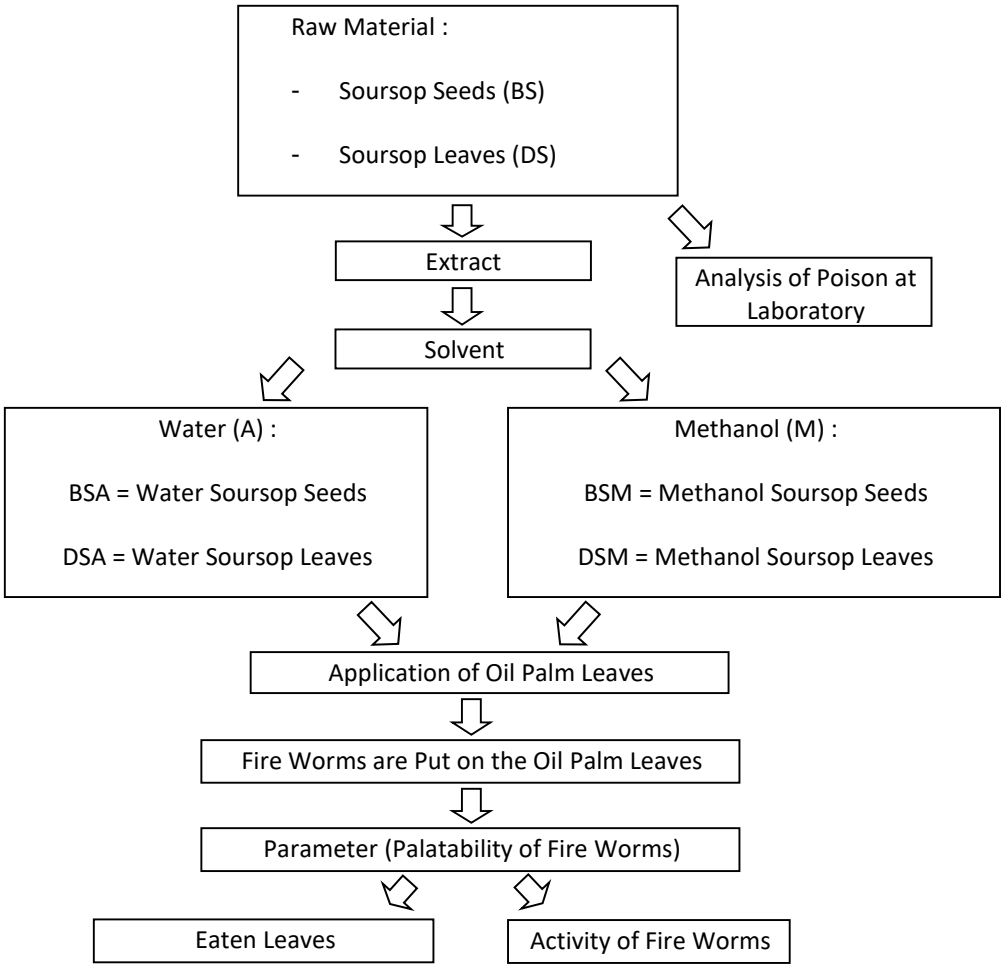


Figure 1. Flowchart of Research

## RESULTS AND DISCUSSIONS

### Results

1. Observation on the Dead Fire Worms Following the Application of Biopesticide

Based on results of the research, data showed that different treatments of biopesticide have significant difference with the control. In accordance with the application of biopesticide against the oil palm's leaves, tobacco extract and methanol solvent are the most effective way to eradicate fire worms, in which they died at the first day following the application. The active fire worms became weak following the application of *pesnap* and tobacco extract, and finally died. However, in treatment K0 (control) without the application of *pesnap*, the fire worms died at the 6$^{th}$ day. It is presented in Table 1 below.



ISSN 2053-5805(Print), ISSN 2053-5813(Online)

**Table 1. Average died-fire worms following the application of biopesticide**

| Treatment | Day of Died-Fire Worm | |
|---|---|---|
| | Water | Methanol |
| K0 | 6a | 6a |
| BS | 2cd | 2cd |
| DS | 2cd | 2cd |
| S | 4b | 4b |
| BL | 2cd | 2cd |
| T | 1d | 1d |
| Mean | 2.83 | 2.83 |

Figure 1. Fire worms before the application of biopesticide

Figure 2. Fire worms after the application of biopesticide



ISSN 2053-5805(Print), ISSN 2053-5813(Online)

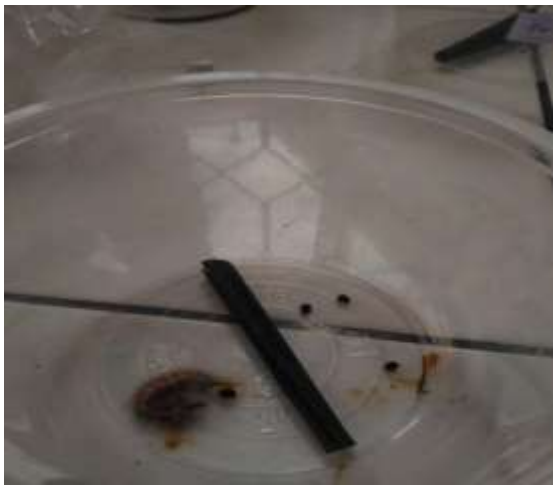

Figure 3. The fire worms died following the application of biopesticide

2. Observation on Eating Activity of the Fire Worms after the Application

Based on results of the research, eating activity of the fire worms reduced following the application of biopesticide. Data of the research showed that Different treatments of *pesnap* have significant difference with the control, in which the fire worms did not eat the leaves since the first day ($1^{th}$) whether the treatment of tobacco extract was applied using water or methanol solvents. All fire worms did not eat the oil palm leaves, and the results are presented in Table 2 below.

**Table 2. Average day of eating activity**

| Treatment | The last day of eating activity | |
|---|---|---|
| | Water | Methanol |
| K0 | 6a | 6a |
| BS | 1d | 1d |
| DS | 2c | 1d |
| S | 1d | 3b |
| BL | 1d | 2c |
| T | 0e | 0e |

3. Percentage of Decrease on Eating Activity

Based on results of the research, data shows that the most effective treatment, which decreases eating activities 100%, is the applications of *pesnap* from tobaccos' extract that using water and methanol solvents. Meanwhile, the most effective solvent that could decrease eating



ISSN 2053-5805(Print), ISSN 2053-5813(Online)

activities is methanol solvent, which could decrease eating activity 52.8%. They are presented in Table 3 below.

**Table 3. Average Percentage of Decrease on Eating Activity**

| Treatment | Decrease Eating Activity | |
|---|---|---|
| | Water | Methanol |
| K0 | 0.0 | 0.0 |
| BS | 30 | 15 |
| DS | 21.5 | 20 |
| S | 30 | 26 |
| BL | 50 | 18 |
| T | 100 | 100 |
| Mean | 38.58 | 29.83 |

## DISCUSSIONS

Results of observation on the effect of biopesticide application against palatability of fire worms are presented in Table 1, 2, and 3. Those three tables indicate that the whole biopesticide treatments (BS, DS, S, BL, and T) have significant difference with the control. It shows that the application of biopesticide, such as extracts of soursop's seeds, soursop's leaves, citronella, pepper's seeds, and tobacco, have affected on palatability of the fire worms, which accelerate their death, lose their palatability (appetite), and decrease eating activities of the fire worms, however, it shows that biopesticide made of those extracts will accelerate the fire worms' death or it is so-called as anti-feedant and insecticide.

Table 1, 2, and 3 present that biopesticide of tobacco's extract, using water and methanol solvents, is the most effective in controlling palatability of fire worms, in which they died at the first day following the application due to they did not eat the treated leaves and their eating activities decreased 100%. It is presumed that tobacco contains nicotine, which is poisonous and when the fire worms come in contact with the poison, they will be poisoned and lose their palatability, and finally died.

According to Kardinan. A (2002), tobacco contains nicotine and it is also used as repellent, fungicide, and acarycide, which works as contact poison, stomach, respiration, and systemic. However, according to Isroi (2010), tobacco contains nicotine and it is also used as repellent, insecticide, fungicide, acarycide, contact poison, stomach poison, and respiration poison.

## CONCLUSIONS AND SUGGESTIONS

### Conclusions

Based on results of the research, it can be concluded that the best biopesticide will reduce palatability of fire worms, such as pesticide of tobacco's extract by methanol solvent, in which the fire worms died within 2 hours following the application at the first day, the fire worms did not eat the leaves and their eating activities decreased 100%.



ISSN 2053-5805(Print), ISSN 2053-5813(Online)

**Suggestions**

Further research is required concerning with determination of dose on biopesticide and direct application to oil palm plantation, which has been infested by fire worms.

**REFERENCES**

Anonim. 2012. Ways of Making Biopesticide (*Cara Membuat Pestisida Organik*). *G hambertani com.* (15 February 2012).

Anonim. 2010. Biocontrol or Biopesticide (*Pengendalian Hayati atau Bio Pestisida Alami*). *add a commet.* (28 May 2010).

Häring. A., S. Dabbert, F. Offermann, H. Nieberg. 2001. Benefits of Organic Farming for Society. *European Conference – Organic Food and Farming, 10.-11. May 2001, Copenhagen, Denmark*

Hendrayana, D. 2010. Recognizing Plants for Biopesticide (*Mengenal Tanaman Bahan Pestisida Nabati*). Cianjur. 26 pp.

Kardinan, A. 2000. Biopesticide : Ingredients and Application (*Pestisida Nabati; Ramuan dan Aplikasi*). 2nd print. Penebar Swadaya, Jakarta.

Kardinan, A. 2002. Biopesticide : Ingredients and Application (*Pestisida Nabati; Ramuan dan Aplikasi*). 4th print. Penebar Swadaya, Jakarta.

Kardinan, A. and M. Iskandar. 1997. Effect of Some Plant Extract as Bio-Molluscidal against Gold Snail, *Pomacea canaliculata* (*Pengaruh Beberapa Jenis Ekstrak Tanaman Sebagai Moluskisida Nabati Terhadap Keong mas, Pomacea canaliculata*). Journal of Indonesian Plant Protection II (2) : 86-92.

Maryani, I. 1995. Toxicity of Soursop's Seeds Coarse Extract (*Annona muricata* Linn.) and *Saliara* (*Lantana camara* Linn.) Leaves, Solely and Mixture, against *Spodoptera exiqua* Hubner (Lepidoptera : Noctuidae) Larvae on Onion (*Allium ascalonicum* Linn.) at Laboratory. Thesis. Faculty of Agriculture, Padjadjaran University, Bandung. (*Toksisitas Ekstrak Kasar Biji Sirsak (Annona muricata Linn.) dan Daun Saliara (Lantana camara Linn.) Secara Tunggal maupun Campurannya Terhadap Larva Spodoptera exiqua Hubner (Lepidoptera : Noctuidae) Pada Tanaman Bawang Merah (Allium ascalonicum Linn.) di Laboratorium. Tesis Fakultas Pertanian Universitas Padjadjaran, Bandung*).

Oka, I, N. 1995. Integrated Biocontrol and Its Implementation in Indonesia (*Pengendalian Hayati Terpadu dan Implementasinya di Indonesia*). Gadjah Mada University Press, Yogyakarta.

Prijono, D. 1988. Insecticidal Test: Guidelines for Practicum. Department of Pest and Disease, Faculty of Agriculture, Bogor Agricultural University, Bogor (*Pengujian Insektisida : Penuntun Praktikum. Jurusan Hama dan Penyakit Tumbuhan, Fakultas Pertanian, Institut Pertanian Bogor, Bogor*).

Rukmana. R, 2007. Farming Operation of Shrub Pepper (*Usaha Tani Lada Perdu*). Publisher Kanisius, Yogyakarta.

Setyamidjaja. D, 2003. Oil Palm Cultivation (*Budidaya Kelapa Sawit*). Publisher Kanisius, Yogyakarta.



ISSN 2053-5805(Print), ISSN 2053-5813(Online)