

# Activities Testing of Mengkudu Folium Extract Powder (*Morinda citrifolia*) as *Aedes aegypti* larvicide 2018

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**Abstract.** Dengue Fever is caused by one of four different dengue viruses. This disease is spread through mosquitos (*Aedes aegypti* and *Aedes albopictus*) that are found in a tropical and subtropical area, especially on the islands of Indonesia. *Mengkudu* folium contains useful chemical substance, namely *Morinda citrifolia*, that functions as stomach poisoning to larva *Aedes aegypti*'s digestive system. Therefore the larva cannot live and eventually die. The purpose of this research was to investigate the chemical activity of *mengkudu* folium extract powder (*Morinda citrifolia*) as larvicide to *Aedes aegypti*. This research employed experimental design and was conducted at Chemistry Laboratory of both Akademi Farmasi Samarinda and Universitas Muhammadiyah Kalimantan Timur. The main substance tested in this research was *mengkudu* folium extract powder (*Morinda citrifolia*). The test was conducted with *mengkudu* folium extract powder with different concentrates: 1%, 3%, and 5%. Water and Abate powder were used as a negative control. Observation periods were 15 minutes, 1 hour, 2 hours, 9 hours, and 24 hours. The results showed that *mengkudu* folium extract powder could be the best larvicide at 5% concentrate towards 55% of *Aedes aegypti*'s larva death within 24 hours with LC<sub>50</sub> is 40,27 µg/ml.

**Keywords:** Mengkudu Folium (*Morinda citrifolia*) Extract, larvicide, *Aedes aegypti*.

## 1 Introduction

Dengue Fever is one kind of infectious disease caused by one of four different dengue viruses, and it is spread through mosquitos, especially *Aedes aegypti* and *Aedes albopictus*. These mosquitos are usually found in the tropical and subtropical area including in Indonesia [1].

The Republic of Indonesia through the Ministry of Health has recorded that in Indonesia the numbers of people suffering from dengue fever in the period between January-February 2016 were 8.487 and the fever had caused death for 108 patients. In Indonesia, the age category that suffered the most were those in the category of 5-14 years old reaching up to 43.44%<sup>1</sup>. The case of dengue fever in East Kalimantan had increased at the beginning of 2016 with 10.712 cases [2]. In Samarinda, the capital of East Kalimantan province, the number of the case had reached 2.814 cases [2].

As the spread of the disease through mosquito is very dangerous, preventive actions need to take place. One of the efforts that can be done is by cutting the chain of mosquitos' lives cycle with chemical or non-chemical substance. There are various methods that can be used to

cut the life span of mosquitos; one of them is killing the vector with abate powder. This powder can be used by pouring it on the water that is rarely cleaned within 9 days since that is the period of a mosquito larva transforming into a mosquito.

*Mengkudu* contains some useful chemical substances. Fitochemical qualitative testing on *mengkudu* folium showed that it contains larvacide substance such as alkaloids, saponins, phenolic, triterpene, and flavonoids [3]. These substances function as stomach poisoning that caused a digestive problem on the larva; as a result, the larva fails growing and eventually dies [4]. Based on the study conducted by Rizqi Amalia, the result suggested water with 12% concentrate from squeezed *mengkudu* folium has a killing effect of 84% on the larva of *Aedes aegypti*. Based on that fact, this study was developed to test the dried powder of *mengkudu* folium extract as *Aedes aegypti* larvacide [5]. The purpose of the study was to investigate the activity of the dried powder of *mengkudu* folium extract as *Aedes aegypti* larvacide.

## 2 Method

This study employed an experimental design. The study was conducted at chemistry laboratory of Akademi Farmasi Samarinda and Universitas Muhammadiyah Kalimantan Timur. The experimental tools that were used in this research were glass jar (for extraction), funnel, Buchner funnel, and vacuum pump, rotary evaporator, oven (for drying the powder) powder screener no 16 and 20, and analytical weighing unit. The materials used in the experiment were *mengkudu* folium (*Morinda citrifolia*), *aquades*, ethanol 96%, lactose, PVP (Polyvinylpyrrolidone), *Aedes aegypti* larva.

There was some 300 *Aedes aegypti* larva used for 3 experiments. The data were analyzed statistically with independent sample test to investigate the effectiveness of dried powder of *mengkudu* folium extract as *Aedes aegypti* larvacide. The extraction of *mengkudu* folium was conducted with *maceration* method, that the folium was washed clean and then it was dried. After that, a blender was used to process the dried folium. The blended dried folium was mixed with other substance (ethanol 96%) with ratio 1:4. The sample of the *mengkudu* folium extract solution was put into a glass jar and then the researcher added some ethanol 96%. The solution was steered well, and the jar was covered with gauze for three days. During the wait of three days, the researcher sometimes steered it.

When the process had finished, the solution was filtered and put into Erlenmeyer vacuum by using Buchner funnel and vacuum pump. The solution was concentrated by using rotary evaporator. The process of making the dried powder started with weighing the materials. The extract solution of *mengkudu* folium was mixed with PVP and lactose until the solution reached 100 grams. Ethanol was dropped little by little on the solution until firm mass was formed (can be placed on hand). The wet mass was filtered by using powder screening no. 16 until granules were formed. The granules were dried on 50°C temperature for one hour until they dried. The dried granules were then filtered again by using powder screening no. 20.

**Table 1.** Dried powder formula

<b>Materials</b>	<b>Formula I</b>	<b>Formula II</b>	<b>Formula III</b>
Mengkudu folium extract	1%	3%	5%
PVP	2%	2%	2%
Lactose	ad 100 g	ad 100 g	ad 100 g

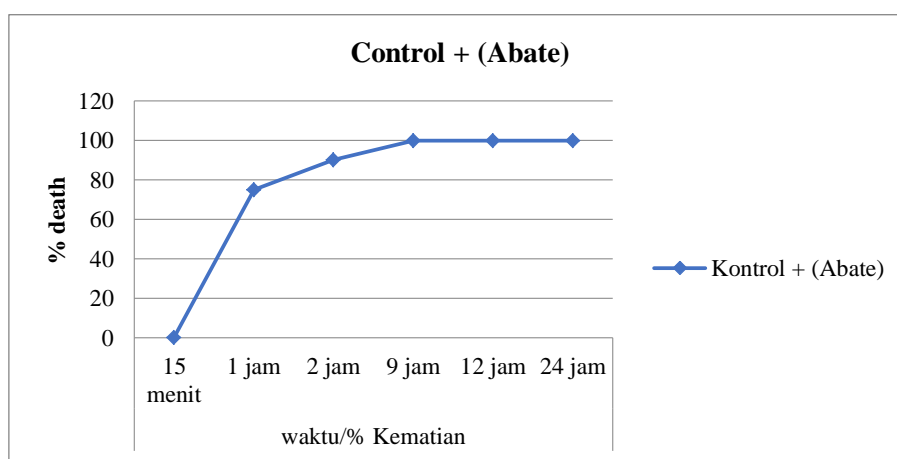
The experiment of its activities was conducted by preparing 5 cups with each concentrated of dried extract powder of 1%, 3%, and 5%. The negative control cups were filled with *aquades*, and positive control cups were filled with abate powder. On each cup were placed 20 larvae of *Aedes aegypti* and then the cups were covered with gauze. Next, the extract powder was mixed into the cups with the composition of 2 grams. The observation was conducted in the first 15 minutes, 1 hour, 2 hours, 9 hours, and 24 hours.

### 3 Results

**Table 2.** The results of the activity testing of *mengkudu* folium extract powder.

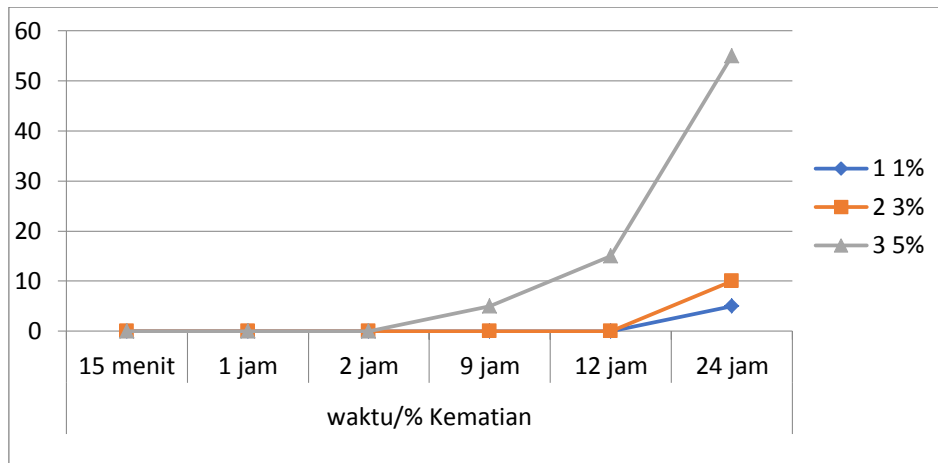
No	Concentration	Time/% death					
		15 minutes	1 hour	2 hours	9 hours	12 hours	24 hours
1	1%	0	0	0	0	0	5
2	3%	0	0	0	0	0	10
3	5%	0	0	0	5	15	55
4	Control + (Abate)	0	75	90	100	100	100
5	Control - (water)	0	0	0	0	0	0

The table showed that the use of *mengkudu* folium extract with concentrate 5% caused the death of the larva up to 5% within 720 minutes. Furthermore, with the same percentage of concentrate of 5%, the extract could cause the death of larva up to 15%. In 1440 minutes with the concentrate of 1%, 3%, 5% the extract had succeeded killed the larva with a death rate of 5%, 10%, and 55%.



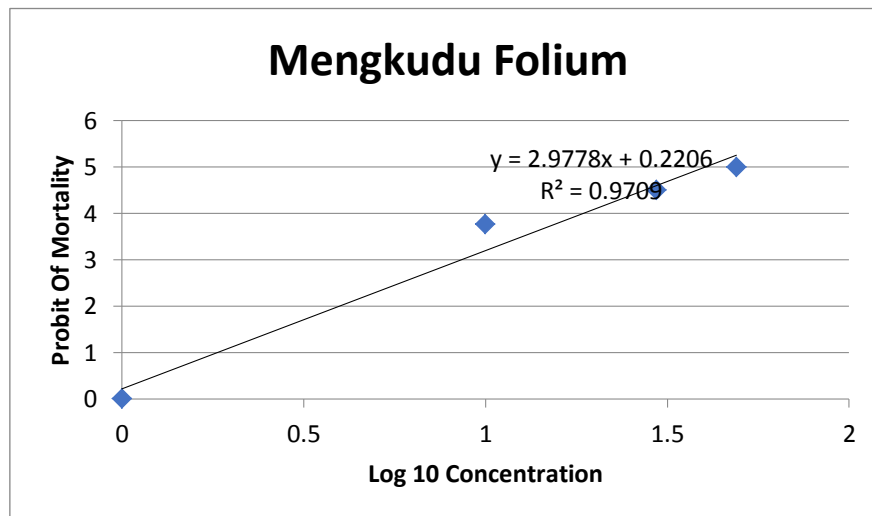
**Graphic 1:** Activity testing of Abate Powder

Graphic 1. showed that the death rate of *Aedes aegypti* reached 100% within 420 minutes on the testing of abate powder.



**Graphic 2** Activity testing of extract powder of *mengkudu* folium

Graphic 2. The result of *mengkudu* extract powder showed that 1% extract had larvacide effect of 5%, 3% extract had larvacide effect of 10% and 5% extract affected larvacide up to 55% in 24 hours.



**Graphic 3** Analysis  $LC_{50}$

Graphic 3. The results showed that mengkudu folium had the effectiveness of larvacide *Aedes aegypti* as an alternative to natural larvicides. It can be seen from the results of the  $LC_{50}$  is 40.27  $\mu\text{g/ml}$ , with the regression equation  $y = 2.9778x + 0.2206$  and the value  $R^2 = 0.9709$ .

## 4 Discussion

The showed that the use of *mengkudu* folium extract with concentrate 5% caused the death of the larva up to 5% within 720 minutes. Furthermore, with the same percentage of concentrate of 5%, the extract could cause the death of larva up to 15%. In 1440 minutes, with the concentrate of 1%, 3%, 5% the extract had succeeded killed the larva with a death rate of 5%, 10%, and 55%.

Meanwhile, in Rizqi Amalia's research, she used the squeezed water of *mengkudu* folium, and the results of her study showed that the larva's death rate was 85% with the concentrate of 12 [5] within 1440 minutes. On the other hand, a study conducted by Rochmat showed that the use of ethyl acetate extract of *Beluntas* folium showed the best result of  $LC_{50}$  brought about 96,34 ppm [6]. It showed almost similar results with Rizqi Amalia's study that used 12% concentrate that resulted in 85% death rate of *Aedes aegypti* larva.

Showed that the death rate of *Aedes aegypti* reached 100% within 420 minutes on the testing of abate powder. The results of the testing revealed the release of the active substance of abate powder reacted quickly to kill the larva. Abate powder has disposition similar to toxic that affects the larva so that it can cause death to the larva in 3 hours. This toxic disposition is created because abate has organic phosphate substance containing phosphorothioate. Therefore it could endanger the health of humans when they consumed water containing this substance consistently in a long period.

The result of *mengkudu* extract powder showed that 1% extract had larvacide effect of 5%, 3% extract had larvacide effect of 10% and 5% extract affected larvacide up to 55% in 24 hours. The ratio between abate powder and *mengkudu* folium powder was 1:1, that was 2 grams of each powder in 200 ml water. The results showed that *mengkudu* folium had the effectiveness of larvacide *Aedes aegypti* as an alternative to natural larvicides. It can be seen from the results of the  $LC_{50}$  calculation analysis on the BSLT (Brine Shrimp Lethality Test) obtained that the  $LC_{50}$  is 40.27  $\mu\text{g/ml}$ , with the regression equation  $y = 2.9778x + 0.2206$  and the value  $R^2 = 0.9709$ . The Nisa, K research showed that the statistical results on *Mengkudu* Semen and Folium extract at 2% concentration could larvacides 100% and 45% of *Aedes aegypti* larvae [7]. It suggests that  $LC_{50}$  of the *mengkudu* folium extract powder was very effective to kill *Aedes aegypti* larva. Also, not only is it safe to consume water containing the extract powder of *mengkudu* folium for humans in a long period, but it is also environmentally friendly.

*Mengkudu* has contents including alkaloids, saponins, tannins, and steroid glycosides. Where the content has many functions, saponins and alkaloids function as a poison to the stomach of *Aedes aegypti* larvae. Alkaloids have the properties of inhibiting the growth of larvae, especially the three main hormones, namely the brain, edition, and growth. And can cause the color changes in the body of the larva to be transparent, and the body movements of the larvae become slow when touched.

## 5 Conclusion

From the results of this research, it can be concluded that the extract powder of *mengkudu* folium (*Morinda citrifolia*) affects some % towards the death rate of *Aedes aegypti* larva with concentrate 1%, 3%, and 5% within 15 minutes up to 24-hour testing experiment. The highest death rate of 55% occurs on 5% extract concentrate within 24 hours with  $LC_{50}$  is 40,27  $\mu\text{g/ml}$ .

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