EFFECTIVENESS OF MANGROVE PLANT (*Rhizophora stylosa)* AS NATURAL LARVACIDES OF *Aedes aegypti*

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ABSTRACTs

The number of dengue morbidity in 2013 was 45.85% per 100,000 population (112,511 cases) with a mortality rate of 0.77% or 871 deaths. In 2014 until the beginning of April, dengue morbidity rates were recorded at 5.17% per 100,000 population or 13,031 cases with a mortality rate of 0.84% or 110 deaths. Larvicides are derived from plant extracts *Rhizophora mucronata*. Some of the active compound contained in *Rhizophora mucronata* form of alkaloids, saponins, flavonoids and polyphenols. The content of the active compound is known to be an insecticidal substance. The development of alternative insecticides is by killing mosquitoes, especially in the larval stage using natural larvacides, which is expected to reduce the incidence of DHF. This study includes the type of experiment that is testing the effectiveness of the *Rhizophora mucronata* plant which will be exposed to *Aedes aegypti larvae*. The research was conducted at the Ministry of Health Polytechnic Building Mamuju, West Sulawesi. The time of this research was May - September 2017. The object of this study was instar III and IV aedes aegypti *larvae*. Stages of research activities include making *Rhizophora mucronata* plant extracts, preliminary test stages and research test stages. Data collected in the form of primary data obtained from the calculation of the number of deaths of Aedes aegypti *larvae* during the study, then processing the data through the stages of Editing, Coding, Entry, and Tabulating. The results showed that the number of larval deaths exposed to the roots of the *Rhizophora mucronata* plant extract was 63.3%, making it effective in killing Aedes aegypti *larvae* because of more than 50%. Whereas the flowers, bark, leaves and fruit are not effective because they are less than 50% in killing Aedes aegypti *larvae*. In subsequent studies, plant parts were used which effectively killed *larvae* by comparing the concentrations.

Keywords: *Aedes aegypti, Botanical Larvacides, Dengue Hemorrhagic Fever (DHF), Rhizophora stylosa*

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is caused by the dengue virus of the genus *Flavivirus,* family of *Flaviviridae*. DHF is transmitted to humans through the bite of the Aedes mosquito infected with the Dengue virus. DHF is found in tropical and sub-tropical regions. Data from all over the world shows that Asia ranks first in the number of dengue sufferers every year. Meanwhile, from 1968 to 2009, the World Health Organization (WHO) recorded the country of Indonesia as the country with the highest DHF cases in Southeast Asia (Epidemiology Surveillance Data Center and Ministry of Health 2010).

In Indonesia, DHF has been a public health problem for the past 41 years. Since 1968 there has been an increase in the number of provinces and districts/cities that are endemic for DHF, from 2 provinces and 2 cities to 32 (97%) and 382 (77%) districts/cities in 2009 (Epidemiology Surveillance Data Center and Ministry of Health 2010). The number of dengue morbidity in 2013 was 45.85% per 100,000 population (112,511 cases) with a mortality rate of 0.77% or 871 deaths. In 2014 until the beginning of April, dengue morbidity rates were recorded at 5.17% per 100,000 population or 13,031 cases with a mortality rate of 0.84% or 110 deaths (P2PL Ministry of Health of the Republic of Indonesia, 2014).

The case of dengue hemorrhagic fever in 2011 in Mamuju Regency recorded 173 people suffering from dengue and the death of only 1 person. In 2012 the number of dengue cases was recorded there were 100 people and one person died. The highest incidence of cases in the Binanga Community Health Center area in five districts in a row from 2013 there were 85 cases and one person died and 2014 there were 48 cases and none died(Mamuju District Health Office, 2015).

Vector control can be carried out chemically, mechanically and biologically. The most commonly used controls today are chemical control by using insecticides because they have more effective works effect and results are quickly seen when compared to biological controls (Supartha 2008). One development of alternative insecticides is by killing the *larvae* of mosquitoes, especially at the stage of using natural larvicides. With this effort expected development life cycle will be delayed or interrupted due to the mosquitoes can not develop into adults. The results showed that larvicides are derived from plant extracts that are safe for the environment, can be degraded, and are specific to the target (Kihampa et al., 2009). Therefore we need

an alternative larvicides, one of them with natural larvicides derived from plants is toxic to insects but harmless to humans and the environment (Setiawan, 2010).

Bruguiera gymnorrhiza mangroves contain alkaloids, saponins, flavonoids, tannins and polyphenols (Mahato et al., 1988), flavonoids and saponins can be toxic (Liebezeit & Rau, 2001). Compounds such as berberina, emitina, quinine and tetramethyl pyrazine including alkaloids act as antimicrobials. Phenolic compounds in wood tissue have aromatic amino acid compounds, which originate from the cyclic acid derivatives as herbicides.

The results of Liem, et al. (2013) on bare plants (Bruguiera gymnorrhiza) obtained LC50 flower extract = 723.6 ppm and LC50 value for bark extract = 673.9 ppm. Both bark and flower extracts mangrove Tanjang containing saponins can be categorized as high toxicity of highly toxic (<1000 ppm) that can be used as a pesticide plant against mosquito *larvae*. For this reason, research will be carried out on mangrove *Rhizophora mucronata* as natural mosquito larvacides, the reason for choosing these plants is because the *Rhizophora mucronata* mangrove species is the most common species in West Sulawesi and research using *Rhizophora mucronata* is still lacking.

MATERIAL AND METHOD

This study includes the type of experiment that is testing the effectiveness of the *Rhizophora mucronata* plant which will be exposed to *Aedes aegypti larvae*.

The research was conducted at the Politeknik Kesehatan Mamuju, Jalan Poros Mamuju Kalukku in West Sulawesi KM.16 Tadui. The study is planned in May – August, 2017.

The object of this research is instar III and IV *Aedes aegypti larvae*. The number of *larvae* used was 360 *larvae*.

This study used the infundation method. By preparing samples to be used are the roots, barks, leaves, flowers and fruit *Rhizophora mucronata*. Considering the weight of each ingredient to weight ratio and water is 1:10. The powder material is heated in a pan with enough water for 15 minutes starting temperature reaches 90 ° C while occasionally stirring. Filter using flannel while hot, if the amount of liquid needed is still less add hot water to the pulp until the amount of fluid that needs are met. After the liquid is cold, put it into the sample bottle and then insert 20 and IV instar *larvae* as many as 20. Observations were carried out for 24 hours, with observations every 8 hours are 8, 16 and 24. This obsercation takes repetitions 3 times.

RESULT AND DISCUSSION

Based on the results of research conducted at the Integrated Laboratory of Politeknik Kesehatan Mamuju observations obtained during 24 hours were observed three observation times are 8, 16 and 24 hours in a solution of the roots, bark, leaves, fruits, and flowers of mangrove *Rhizophora mucronata.*

Table 1. Distribution of *Aedes aegypti* Larva Death on First Treatment Based on Plant Parts *Rhizophora mucronata*

No	Plant Parts	N	Control	Observations			Total	%
				8 Hours	16 Hours	24 Hours		
1	Roots	20	20	7	8	4	19	95
2	Fruits	20		0	0	2	2	10
3	Leaves	20		8	0	0	8	40
4	Barks	20		1	0	2	3	15
5	Flowers	20		6	1	0	7	35

Table 2. Distribution of *Aedes aegypti* Larva Death on Second Treatment Based on Plant Parts *Rhizophora mucronata*

No	Plant Parts	N	Control	Observations			Total	%
				8 Hours	16 Hours	24 Hours		
1	Roots	20	20	5	9	4	18	90
2	Fruits	20		2	2	4	8	40
3	Leaves	20		7	0	0	7	35
4	Barks	20		7	2	0	9	45
5	Flowers	20		5	0	1	6	30

Table 3. Distribution of *Aedes aegypti* on Third Treatment Based on Plant Parts *Rhizophora mucronata*

No	Plant Parts	N	Control	Observations			Total	%
				8 Hours	16 Hours	24 Hours		
1	Roots	20	20	1	0	0	1	5
2	Fruits	20		1	1	0	2	10
3	Leaves	20		1	0	2	3	15
4	Barks	20		4	6	5	15	75
5	Flowers	20		1	1	0	2	10

Table 4. Distribution of *Aedes aegypti* in Several Treatment Based on Plant Parts *Rhizophora mucronata*

No	Plant Parts	Percentage			Average (%)
		Treatment I	Treatment II	Treatment III	
1	Roots	95	90	5	63,3
2	Fruits	10	40	10	20
3	Leaves	40	35	15	30
4	Barks	15	45	75	45
5	Flowers	35	30	10	25

Aedes aegypti as the vector of dengue disease can be used as one indicator of the high incidence of dengue cases. For that, we need a way to curb the high density of *larvae* by using *Rhizophora mucronata* plant as a natural larvicide to kill the *larvae* of *Aedes aegypti*.

Based on the results of research conducted shows that all parts of the plant affect the mortality of *larvae* of Aedes aegypti. The most effective mortality occurred in the root section with an average mortality of 63.3% of the total *larvae* of 20 *larvae*. It is strongly associated with the content of secondary metabolites of each part of the plant that affect mortality of *larvae* exposed for 1x24 hours and observed for three observations in 8 hours, 16 hours and 24 hours.

The results of laboratory testing on the first treatment showed that 95% of larval mortality occurred in the roots and fruit section can only kill 10% of the total *larvae* provided. The results of laboratory tests on the second treatment showed that 90% of the *larvae* died after being exposed to the roots of the *Rhizophora mucronata* plant while the part of the plant that killed the least *larvae* was part of the flower, which was 30% of the total *larvae* provided. For testing on the third treatment it was found that 75% of the bark plant was able to kill the *larvae* from the total *larvae* provided and the part of the plant which only slightly killed the *larvae* was the root of 5%. The results of a third treatment are different from the first and second treatment, it is influenced by several factors, one of which is the temperature of the room at the time of testing.

The part of the *Rhizophora mucronata* plant shows a difference in the number of dead *larvae*. It shows the differences in the content of chemical compounds contained in the plant parts which gained the highest

number of larval mortality occurred in the roots and the lowest on the fruit. Djojosumarto (2008) explains that "Toxic compounds or elements even in low concentrations when entering the body of *Aedes aegypti larvae* will cause chemical reactions in the body's metabolic processes which can cause death".

The chemical compounds in the *Rhizophora mucronata* plant are phenolics, alkaloids, steroids, saponins, flavonoids, and tannins. Dead *larvae* showed damage to the digestive tract. This is according to a statement Shasi and Ashoke (1991) in Simanjuntak et al. (2001) that saponins can reduce the surface tension of the mucous membrane of the digestive tract structure of the *larvae* to become corrosive. In this study showed that some fourth-instar *larvae* turn into pupae and still alive because it is not affected by tembelekan juice. The pupa is not affected by saponins because it has a body wall structure consisting of hard cuticles so that saponin compounds cannot penetrate the pupa wall (Aminah et al., 2001).

Tannin component acts as a defense against insects by blocking the insect to digest food. Tanin can disturb insects in digesting food because tannins will bind proteins in the digestive system that insects need for growth so that the process of absorption of protein in the digestive system becomes disrupted. Tannins function suppress food intake, growth rate and ability to survive. Tannins and saponins have a bitter taste that can cause eating inhibition mechanisms. Besides, the bitter taste also causes the *larvae* to not eat so that the *larvae* will starve and eventually die (Yunita et al., 2009).

Other chemical compounds found in *Rhizophora mucronata* is flavonoids. Flavonoids term was given to phenol compounds derived from the word flavones which is the name of one of the largest amounts in plant flavonoids. Flavonoids gives color to the flower and fruit. Also, the flavonoids that have a bitter taste that can be used as a defense and protection against insects, fungi, and herbivores (Lenny, 2006). Flavonoids work as a respiratory poison, which is by entering the body of the *larvae* through the respiratory system, which then will cause wilting of the nerves and damage to the respiratory system and cause the *larvae* to unable to breathe and eventually die. Alkaloids in the form of salt that can degrade the cell membrane to get inside and damage cells and can disrupt the nervous system of the *larvae* by inhibiting the action of the enzyme acetylcholinesterase (Cania, B and Setyaningrum, E. 2013).

Anggoro research results from 2012 showed that the compounds of mangrove leaves in brackish waters Cilacap district contains a lot of polar compounds such as phenolic, alkaloids, steroids, saponins, flavonoids and tannins. Activities of bio-larvacides ethyl acetate extract of the bark of the red mangrove (*Rhizophora stylosa*) due to the flavonoid content of phenolic compounds and alkaloids. Bioactive compounds from plants that have insecticidal activity among others from the class of triterpenoids, flavonoids, and alkaloids (Syahputra, 2001).

The qualitative test results showed that ethyl acetate extract of red mangrove stem skin (Rhizophora stylosa) contained phenolic compounds with FeCl3 test, flavonoids with Shinoda test, and alkaloid with reagent test (Mayer, Dragendorf, and Wagner). Based on the results of the probit analysis, the LC50 values were 4684.20mg / L, 3889.43mg / L, 1853.31mg / L, and 951.32mg / L for each incubation time of 24, 48, 72, and 96 hours. Based on the LC50 value at 96 hours incubation, it can be concluded that the ethyl acetate extract has moderate category toxicity because the value is between 100-1000 mg / L (Amelia and Suyatno, 2014). It can also be supported by previous research, by polar extract of *Rhizophora mucronata* bark containing alkaloid compounds that can inhibit insect growth or overcome pests, especially armyworms (Spodoptera litura) which attack crops and vegetables (Chalista, V. 2010). The use of mangroves as traditional medicine can be used as an anti-cancer in which the leaves of the mangrove *Rhizophora mucronata* species in vitro can inhibit cancer cell growth with LC 50 of 582.00 µg / mL (Warsinah et.al, 2005).

The use of plants as a natural insecticide from the research results are considered potent as one of the methods and alternatives in controlling the population of *Aedes aegpty* which is evident from the results mangrove *Rhizophora mucronata* without the use of solvents other than water can kill *larvae* although the most effective are the roots of being able to lethal *larvae* above 50% of the samples.

CONCLUSION

The number of larval deaths exposed to the roots of the *Rhizophora mucronata* plant extract was 63.3%, making it effective in killing *Aedes aegypti larvae* because of more than 50%. Whereas the flowers, bark, leaves, and fruit are not effective because they are less than 50% in killing *Aedes aegypti larvae*.

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