Effectiveness of Saga Tree Seed Extract (Adenanthera Pavonine) as Larvacide of Mosquito Aedes Aegypti

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Abstract

From 2009 to 2015, there was an increase in the number of cases of Dengue Fever in districts or cities. Aedes aegypti mosquito larvae have been resistant to Themephos Abate 1 SG in Surabaya, Palembang, and several regions in Bandung. This study aims to determine the effective concentration of tree saga seed extract against the death of Aedes aegypti mosquito larvae and determine the effectiveness of the concentration at the value of LC50 for 24 hours. This study was Experimental Laboratory using a complete randomized design method with 3 replications. Data from observations were analyzed with Analysis of Variance (ANOVA). A further test was carried out using the Smallest Significant Difference Test (LSD) at the confidence level of 0.05%. Determination of lethal concentrations was carried out with probit analysis. The results showed that saga tree seed extract at a concentration of 2%, 4%, and 6% was effective against the mortality of Aedes aegypti mosquito larvae. The mortality rate of Ae. aegypti at the concentration of 0.50% was 7%, the concentration of 1% was 10%, the concentration of 1.50% was 12.6%, the concentration of 2% was 13.33%, the concentration of 4% was 17% and the concentration of 6% was 19%. The LC50 value of saga seed ethanol extract in killing Aedes aegypti mosquito larvae was 4.806% with a 24-hour exposure time. That saga tree seed extract with a concentration of 0.50%, 1%, 1.50%, 2%, 4%, and 6% was effective against the mortality of Aedes aegypti mosquito larvae. The fastest mortality time of the larvae was at the concentration of 6% with the total mortality of 18.54%. The LC50 value of saga tree seed extract in killing Aedes aegypti mosquito larvae was 4.806% with a 24-hour exposure time.

Keywords: Aedes aegypti, Larvacide, Mosquito larvae, Saga seeds

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INTRODUCTION

The dynamics of disease transmission is a natural course of disease transmitted by vectors and the factors that influence transmission of the disease include hosts including the behavior of the community, agents, and environment. Vectors are arthropods (insects) that can transmit, move and/or become transmissible sources of disease to humans. Vector control is all activities or actions aimed at reducing vector populations as low as possible so that their presence is no longer at risk for vector disease transmission in an area or avoiding community contact with vectors so that transmission of vector-borne diseases can be prevented. Vector-borne disease is one of the environment-based diseases that is influenced by the physical, biological and socio-cultural environment (KMK No.347 / 2010).

Trends in Dengue Hemorrhagic Fever (DHF) morbidity during the period 2008-2015, there were 21 provinces (61.8%) representing dengue morbidity rates by the province which had reached the 2015 Strategic Plan of the Ministry of Health target. The Provinces with the highest DHF morbidity in 2015, namely Bali at 257.75, East Kalimantan at 188.46 and North Kalimantan at 112.00 per 100,000 inhabitants. Death from DHF is categorized as high if CFR (Case Fatality Rate) > 1%. Thus in 2015, there were 5 provinces that had high CFR, namely Maluku (7.69%), Gorontalo (6.06%), West Papua (4.55%), North Sulawesi (2.33%), and Bengkulu (1.99%). While the target of the Ministry of Health’s Strategic Plan for dengue morbidity in 2015 is <49 per 100,000 population, thus Indonesia has not yet reached the 2015 Strategic Plan target.

DHF morbidity and the number of districts/cities infected with dengue in 2015 both experienced an increase. In 2014 it was 433 (84.74%) to 446 regencies/cities (86.77%) in 2015. The number of districts/cities affected in 2009-2015, during the period of 2009 to 2015, the number of districts/cities contracted by DHF tended to increase (Indonesian Health Profile 2015).

Mosquitoes include a group of insects that experience complete metamorphosis with a life cycle in the form of eggs, larvae (some instars), pupae and adults. The mosquito eggs hatch in water to become larvae, pupae and then mature on land (Sembel, 2009).

Aedes aegypti mosquito larvae from Surabaya, Palembang and several regions in Bandung have been resistant to Themephos Abate 1 SG (Raharjo, 2006). Likewise, the North Banjarmasin area has resistant Aedes aegypti mosquito larvae against themepos Abate 1 SG dose 0.1/l (Gafur, 2006). Because there has been resistance from mosquito larvae to larvacide abate, the method of control can be done by utilizing active substances from plants (MOH, 1985).
Tree saga seeds contain flavogoid, alkaloid, antitrypsin, hemagglutinin and goitronics which have toxic effects (Suita, 2013).

THE METHODS
The type of research used in this study is an Experimental Laboratories research. The population in this study was Aedes aegypti Mosquito Larvae obtained from the Center for Environmental Health Engineering and Class II Disease Treatment in Ambon. The samples in this study were 525 instar III Aedes aegypti mosquito larvae in each placed in 15 plastic cups, each of which contained 25 plastic cups of Aedes aegypti mosquito larvae.

The implementation of this research was carried out in August - November 2017 in the Basic Chemistry Laboratory of the Department of Chemistry, Faculty of Mathematics and Natural Sciences University of Pattimura, and for the production of saga seed extract while the larvicidal test was carried out at the Environmental Health Engineering Center and Class II Disease Treatment in Ambon. This study uses a complete randomized design with 3 replications. Analysis of observational data will be analyzed by Analysis of Variance (ANOVA) using the SPSS 16.00 program. Then carried out further tests using the Smallest Significant Difference Test (LSD) at the confidence level of 0.05%, and to determine the lethal concentration, a probit analysis is performed.

RESEARCH RESULTS
Mortality of Mosquito Larvae Aedes aegypti Saga Tree Seed Extract
Giving ethanol extract of saga tree seeds to Aedes aegypti mosquito larvae with concentrations of 0.50%, 1%, 1.50%, 2%, 4% and 6% which are applied for 24 hours can be seen in the following table:

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (0%)</td>
<td>0</td>
</tr>
<tr>
<td>0,50%</td>
<td>7 ± 3.00a</td>
</tr>
<tr>
<td>1%</td>
<td>10 ± 3.00ab</td>
</tr>
<tr>
<td>1,50%</td>
<td>12.67 ± 5.50b</td>
</tr>
<tr>
<td>2%</td>
<td>13.33 ± 5.13bc</td>
</tr>
<tr>
<td>4%</td>
<td>17 ± 4.58c</td>
</tr>
<tr>
<td>6%</td>
<td>19 ± 4c</td>
</tr>
</tbody>
</table>

Based on the table above shows that the average and standard deviation of larval mortality of Aedes aegypti mosquitoes at Control concentration is 0, at a concentration of 0.50% the mortality of Aedes aegypti mosquitoes is 7 ± 3.00a, at a concentration of 1%, larval mortality Aedes aegypti mosquito as much as 10 ± 3.00ab, mortality of Aedes aegypti mosquito as much as 12.67 ± 5.50b, at a concentration of 2% as much as 13.33 ± 5.13bc, at a concentration of 4% as many as 17 Aedes aegypti mosquito larvae mortality ± 4.58c and at a concentration of 6% the mortality of Aedes aegypti mosquitoes
was $19 \pm 4c$. The mortality of *Aedes aegypti* mosquitoes at each concentration varied, meaning that the increase in mortality did not follow high concentrations, although throughout the observation period there was an increase in mortality. Based on the results of Analysis of Variant (ANOVA) using two SPSS 16.0 programs, it shows that the value is significant ($<0.05$) which means that the ethanol extract of saga tree seed has an effect on the mortality of *Aedes aegypti* mosquito larvae. The results of further tests using the Smallest Significant Difference test (BNT) showed that the concentration of ethanol extract of *Adenanthera pavonina* saga tree seeds was 0%, 0.50%, 2%, 4% and 6% given significantly different between each concentration but a concentration of 1% and 1.50% is not significantly different. From the results of the BNT test, it is also known that the concentration of ethanol extract of saga tree seeds (*Adenanthera pavonina*) which has a very effective effect on the mortality of *Aedes aegypti* mosquito larvae based on the speed of time is at 2%, 4% concentration of 6%.

**Mosquito Larva Mortality Test Chart Ethanol Extract of Saga Tree Seeds (*Adenanthera pavonina*)**

![Mosquito Larva Mortality Test Chart Ethanol Extract of Saga Tree Seeds (*Adenanthera pavonina*)](image)

**Figure 1.** Larva Mortality

Based on Figure Graph The mortality rate of *Aedes aegypti* mosquitoes at Control concentration was 0, at a concentration of 0.50% the mortality of *Aedes aegypti* mosquitoes at Control concentration was 0, at a concentration of 0.50% the mortality of *Aedes aegypti*
mosquitoes was 7%, at a concentration of 1%, mortality of *Aedes aegypti* mosquitoes as much as 10%, mortality of *Aedes aegypti* mosquitoes at a concentration of 1.50% as much as 12.6%, at a concentration of 2% as much as 13.33%, at a concentration of 4% mortality of *Aedes aegypti* mosquitoes as much as 17% and at concentrations 6% mortality of *Aedes aegypti* mosquitoes as much as 19%. The mortality of *Aedes aegypti* mosquitoes at each concentration varied, meaning that the increase in mortality did not follow high concentrations, although throughout the observation period there was an increase in mortality.

**Figure 2.** *Aedes aegypti* Larvicide Test using Saga Seed Ethanol Extract (Control Concentration 0%)

**Figure 3.** Concentration 0.50%
Figure 4.  Concentration 1%

Figure 5.  Concentration 1.50%

Figure 3.6  Concentration 2%
DISCUSSION

Saga tree seeds as a natural insecticide is the result of extraction of phytochemical content which is made into several concentrations. Based on the results of the probit analysis shows that the LC$_{50}$ value of tree saga seeds contains flavogoid, alkaloid, antitrypsin, hemagglutinin and goitronics which have toxic power (Suita, 2013). To killing *Aedes aegypti* mosquito larvae is a concentration of 4.806% in a vulnerable time of 24 hours with a lower limit value that is and an upper limit value of. While the highest extract concentration given to *Aedes aegypti* mosquito larvae is 6%.

Observations from the 0 time did not show the mortality or mortality of mosquito larvae, while observations from 3 to 24 hours showed the death of mosquito larvae at each concentration. The exception is a concentration of 1% to 1.50% in the sense that increased mortality does not occur at this concentration but occurs otherwise. So that it can be stated that the concentration of saga seed extract 0.50%, 1%, 1.50%, 2%, 4% and 6% given to *Aedes*
*Aedes aegypti* mosquito larvae is effective if it is used as a natural insecticide based on analysis data and observations invulnerable 24 hours.

The occurrence of death of *Aedes aegypti* larvae at various concentrations is thought to be the occurrence of contact poisons and body poisons. Symptoms observed in *Aedes aegypti* mosquito larvae which are in contact with saga seed extract experience abnormal movements while the *Aedes aegypti* mosquito larvae that have experienced death characterize the following: Larvae do not move at all when touched, their bodies are white, elongated and stiff, drowned.

According to Hamidah 2001 in (Banne, 2017) that the initial symptoms observed in larvae that have contact with insecticides usually cause four stages of symptoms, namely: excitation, convulsions (spasms), paralysis (paralysis) and death. In the excitation stage, the larvae show anxiety by cleaning the body such as an antenna or other body parts with the mouth, rolling up the body and performing telescopic movements, namely very rapid up and down movement on the surface of the water.

*Aedes aegypti* larvae are thought to have metabolite compounds from saga seeds, which is toxic. Secondary metabolites contained in the ethanol extract of saga seeds, namely flavonoids, tannins, galactomannan (Silvita et al, 2014). According to Dinata (2009) in Banne (2017) that flavonoid compounds inhibit insect feeding and are also toxic. The flavonoid compounds contained in saga seeds are thought to cause respiratory problems which cause the death of larvae. According to (Haditomo, 2010) the position of the larval body that changes from normal is caused by flavonoids due to the way it enters through the siphon resulting in damage so the larvae must align their position with the water surface to facilitate taking oxygen. According to Sutanto et al (2008), larvicidal toxicity for killing larvae is very dependent on the form of larvacides, the way the compound enters into the body of the larvae, the concentration and amount of compounds in the body of the larvae as well as the size, structure, and habitat of larvae. contact), through the mouth and digestive tract (stomach poison), and through the respiratory system (respiratory poisons). Plant bioactivity is strongly influenced by the content of the chemical compounds contained therein, differences in the content of the chemical compounds that show different pharmacological activities of the plants in question (Halimah, 2010).

**THE CONCLUSION**

Based on the results obtained it can be concluded that, the ethanol extract of saga seeds (*Adenantra pavonina*) concentration of 0.50%, 1%, 1.50%, 2%, 4%, and 6% was effective against the
mortality of *Aedes aegypti* mosquitoes with the speed of larval mortality mosquitoes were at a concentration of 6% with the number of mosquito larvae mortality of 18.54% and the LC_{50} value of saga seed ethanol extract in killing *Aedes aegypti* mosquito larvae was 4.806% with a 24-hour exposure time.

All concentrations used have the potential for larvicide but for the application must be in accordance with effective concentrations and further research is needed on the phytochemical content contained in saga seeds in different locations.

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