

The Effect of Bay Leaf Juice (*Syzygium Polyanthum* (Wight)) on the Death of *Aedes Aegypti* Instar III Mosquito Larvae

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ABSTRACT

*Dengue Hemorrhagic Fever (DHF) is an endemic disease which is a health problem in Indonesia, which can be transmitted through the bite of the *Aedes aegypti mosquito*. Control of the *Aedes aegypti mosquito* as a dengue vector has been widely carried out using synthetic controls, other controls can be carried out using natural larvicides. Bay leaves (*Syzygium polyanthum* (Wight)) are one of the plants that can be used as a natural larvicide because they contain alkaloids, flavonoids, phenolics, terpenoids, tannins, saponins and essential oils. This research aims to determine the effect of bay leaf juice on the death of third instar *Aedes aegypti mosquito larvae*. This research is an experimental study by looking at the death of third instar *Aedes aegypti mosquito larvae* from bay leaf juice. The treatment was carried out by making various concentrations of bay leaf juice, namely 4%, 8%, 16%, 20%, 32%, 64% and 80%. Each treatment container contained 25 third instar *Aedes aegypti mosquito larvae* with 2 repetitions for 24 hours. Data were analyzed using *one way ANOVA* analysis of variance. The conclusion of this research is that bay leaf juice has a significant effect on the death of third instar *Aedes aegypti mosquito larvae* and a concentration of 16% is an effective concentration in killing third instar *Aedes aegypti mosquito larvae*.*

Keywords: *Aedes aegypti*, Bay leaf (*Syzygium polyanthum* (Wight))

INTRODUCTION

*Dengue Hemorrhagic Fever (DHF) is an infectious disease that is one of the health problems in Indonesia caused by the *dengue virus* which can be transmitted through the bite of the *Aedes aegypti mosquito*. The clinical manifestations of dengue fever vary from asymptomatic and symptomatic conditions, consisting of non-specific low-grade fever, *dengue fever* accompanied by shock or *dengue shock syndrome* (DSS). *Dengue* can also attack the liver, often causing complications, namely impaired liver function due to damage to liver cells (Soegijanto, 2012).*

The Indonesian Ministry of Health (2020) stated that there were 95,893 cases of dengue fever in Indonesia with a total of 661 deaths. The five districts/cities with the most dengue cases are Buleleng, Bali (3,313 people), Badung, Bali (2,547 people), Bandung City, West Java (2,363 people), Sikka, NTT (1,786 people), and Gianyar, Bali (1,717 people). Yogyakarta City Health Office (2020) explained that there were 296 cases of dengue fever in Yogyakarta City. The four Kemantren (Districts) with the highest cases include Umbulharjo Kemantren (62 cases), Kotagede Kemantren (49 cases), Mantrijeron Kemantren (53 cases), and Mergangsan Kemantren (28 cases).

DHF cases are a disease that appears every rainy season. Climate change causes changes in rainfall, temperature and humidity, which has an effect on the ecosystem, especially on the breeding of the *Aedes* mosquito vector both before the rainy season and after the rainy season (Gubler, 2010). High rainfall can increase mosquito breeding

places and increase the mosquito population which allows dengue fever outbreaks to increase, so efforts are needed to control the mosquito vector of dengue fever.

Dengue fever can be controlled by breaking the mosquito life cycle at the larval stage. This control can be done by administering synthetic or vegetable larvicides. The use of synthetic larvicides such as abate can have negative impacts on humans and the environment. If the dose of Abate is continuously increased, it will endanger public health and environmental health, if direct exposure to Abate, such as ingestion, will cause poisoning (Runia, 2008) . One alternative that can be used to control mosquito larvae is to develop plant-based ingredients as vegetable larvicides, one of which is bay leaves.

Dwiyanti *et al.* (2017) stated that bay leaf water extract at a concentration of 32 ml/100 ml could cause 55% death of *Aedes aegypti* mosquito larvae . Anggraini (2019) stated that bay leaf solution at a concentration of 55% can kill *Aedes aegypti larvae* by 52 % . Kartini *et al.* (2020) explained that ethanol extract of bay leaves at a concentration of 2% caused larval mortality of 86.6 %.

The death of larvae after exposure to bay leaf extract is due to the fact that bay leaf extract contains active compounds as larvicides. Agustina *et al.* , (2016) stated that bay leaves contain flavonoids, saponins, tannins and alkaloids. Abdullah, (2016) explained that the highest flavonoid content is found in old leaves, then in young leaves.

Laurel tree is a type of spice plant and one of the medicinal plants in Indonesia. The scientific name of the laurel tree is *Syzygium polyanthum* Wight (Utami & Puspaningtyas, 2013). Bay leaves can function as a larvicide. Bay leaves contain alkaloids, flavonoids, phenolics, triterpenoids, tannins, saponins (Perdana *et al.* , 2018).

Saponins can disrupt the insect's digestive system (Fatimah *et al.* , 2004), flavonoids can affect the insect's respiratory system or as respiratory poisons, alkaloids can disrupt the insect's nervous system (Cania & Setyaningrum, 2013) . The total flavonoid content of bay leaves is not less than 1.14 % (Ministry of Health of the Republic of Indonesia, 2017).

Aedes aegypti is a type of mosquito that carries the *dengue virus* and can cause dengue fever. The *dengue virus* is transmitted through the bite of the *Aedes genus mosquito* . The *Aedes Aegypti* mosquito is currently still the main vector or carrier of dengue fever (Sukmawati, 2022) . The *Aedes* mosquito is a mosquito that is often found in tropical and sub-tropical areas. *Aedes* mosquitoes can cause dangerous diseases such as dengue fever and jaundice (Adifian *et al.* , 2013). *Aedes aegypti* just like other mosquitoes. *Aedes aegypti* undergoes a complete metamorphosis life cycle consisting of egg, larva (instar I-IV), pupa, imago (adult mosquito) (Febritasari *et al.* , 2016) .

Aedes aegypti mosquito prefers to be active indoors, or is called endophilic. *Aedes aegypti* is anthropophilic and only female mosquitoes suck blood. *The Aedes aegypti* mosquito usually sucks blood in the morning at 08.00 – 11.00 WIB and in the afternoon at 15.00 – 17.00 WIB (Sudiby, 2016).

Dengue hemorrhagic fever is an infectious disease caused by the *dengue virus* and transmitted through the bite of the *Aedes aegypti mosquito* . This disease can attack everyone and can cause death, especially children and often causes outbreaks (Soegijanto S, 2012).

RESEARCH METHODS

This research is experimental research. This research uses a *true experimental research method* with a *posttest with control group design*, namely measuring the effect of concentration treatment on the experimental group by comparing the group with the control group.

This research was conducted at the Entomology Laboratory of the Center for Environmental Health Engineering and Disease Control (BBTKLPP) Yogyakarta from May to June 2023. The object of this research was third instar *Aedes aegypti mosquito larvae* obtained at the Entomology Laboratory of the Center for Environmental Health Engineering and Disease Control. (BBTKLPP) Yogyakarta.

Making bay leaf juice by weighing the bay leaves, and washing them clean, then drying them, after the bay leaves are dry, then grind them using a blender and make a 1:1 ratio by weighing 2.5 kg of bay leaves then adding 2,500 ml of distilled water and after that let stand for 1 hour then filtered.

Maintenance of mosquito larvae by transferring mosquito larvae into plastic cups containing water from their habitat. If the water from their habitat is lacking, rainwater, wells or mineral water can be added; Feeding mosquito larvae with cat food pellets; Clean the surface of the water if there is dirt. Meanwhile, the research flow is that third instar *Aedes aegypti* mosquito larvae are prepared; 250 ml of clean water was prepared as a negative control; Several concentrations were made, namely 4%, 8%, 16%, 20%, 32%, 64% and 80%. A total of 25 third instar *Aedes aegypti larvae* were put into each concentration container. Each treatment was made in 2 repetitions and observed for 24 hours. III instar *Aedes aegypti mosquito larvae* that were thought to be dead were touched using a pipette. If the larvae did not move, were stiff, black and had no response, it meant the larvae were dead. The data obtained were analyzed using *one way* ANOVA analysis of variance to test mean differences between groups or types of treatment.

RESULTS AND DISCUSSION

bay leaf juice to third instar *Aedes aegypti* mosquito larvae showed that the larvae died after being exposed to bay leaf juice for 24 hours. Larval mortality is observed in Table 1.

Table 1. Number of deaths of third instar *Aedes aegypti* mosquito larvae in bay leaf juice after 24 hours.

Treatment	Number of Larvae	Death of Mosquito larvae		Total Deaths	Mean (tail)
		P1	P2		
Negative control	25	0	0	0	0
4%	25	1	0	1	1
8%	25	1	3	4	2
16%	25	1	4	5	3
20%	25	11	9	20	10
32%	25	4	2	6	3
64%	25	4	8	12	6
80%	25	12	15	27	14

Based on Table 1, bay leaf juice at a concentration of 80% is able to kill third instar *Aedes aegypti mosquito larvae* with an average of 14 out of 25 larvae. The highest concentration of bay leaf juice was able to cause the most larval deaths. To determine the effect of different concentrations of bay leaf juice on larval mortality, a *one-way* ANOVA analysis of variance test was carried out . The *one way ANOVA* analysis of

variance test was determined after the data normality test showed that the data was normally distributed.

The results of the data normality test in this study show that the data is normally distributed with a significance value of 0.580. Furthermore, the results of the ANOVA test show that there is an effect of providing various concentrations of treatment on the death of third instar *Aedes aegypti* mosquito larvae with a significance value of 0.002 as shown in Table 2.

Table 2. Data normality test and ANOVA test

Concentration treatment with bay leaf juice	Number of Larvae	Death of Mosquito larvae		P1	P2
		P1	P2		
Negative control	25	0	0	0.580	0.002
4%	25	1	0		
8%	25	1	3		
16%	25	1	4		
20%	25	11	9		
32%	25	4	2		
64%	25	4	8		
80%	25	12	15		

P1 significance value of data normality test > 0.05

P2 ANOVA test significance value < 0.05

Discussion

The difference in concentration of dsun salam feelings can kill third instar *Aedes aegypti* mosquito larvae. In line with Ali & Mulyati (2021) stated that bay leaf extract at a concentration of 2% can kill larvae with an average death of 8 individuals (33.6%). Windari *et al.* (2021) stated that bay leaf extract at a concentration of 20 ml/200 ml could cause the death of 4 larvae. Waskito & Cahyati (2018) stated that bay leaf extract in granule form at a concentration of 15 mg/ml can kill 10 mosquito larvae.

Third instar *Aedes aegypti* mosquito larvae in this study was thought to be due to the active compound content in bay leaf juice. Bay leaves are known to contain alkaloids, flavonoids, phenolics, triterpenoids, tannins, saponins (*Prime et al.*, 2018). The flavonoid content in bay leaves is known to function as a respiratory poison (Muta'ali & Purwani, 2015), this can be seen from the position of the larva's body which was originally normal to change to abnormal. Changes that occur in the larvae can be caused by flavonoids that enter through the siphon and cause damage so that the larvae must align their position with the surface of the water with the aim of making it easier for the larvae to take in oxygen (Cania & Setyaningrum, 2013).

The one-way ANOVA analysis of variance stated that bay leaf juice in various concentrations had a significant effect and caused the death of third instar *Aedes aegypti* mosquito larvae. A 16% concentration of bay leaf juice caused 12% larval death. According to WHO (2005), a larvicide concentration is considered effective if it can cause the death of test larvae of around 10-95%.

CONCLUSION

Based on the results of research conducted regarding the effect of bay leaf juice (*Syzygium polyanthum* (Wight)) on the death of third instar *Aedes aegypti* mosquito

larvae , it can be concluded that bay leaf juice has a significant effect on the death of third instar *Aedes aegypti mosquito larvae* . A concentration of 16% is an effective concentration in killing third instar *Aedes aegypti mosquito larvae*. Meanwhile, the suggestion from the research that has been carried out is to use positive control as a comparison

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