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## The Effectiveness of Evaporation and Spray Methods in Killing *Aedes Aegypti* Using Basil (*Ocimum sanctum*, Linn) Leaf Extract

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### Abstract

Dengue *Hemorrhagic Fever* (DHF) are acute febrile disease caused by virus *dengue* the into the human blood circulation through the bite *Aedes aegypti*. Prevention of the spread of dengue disease can be done by breaking the chain of transmission through vector control. The aim of this research was to determine the effectiveness of the method of evaporation and spray the deadly *Aedes aegypti* using basil leaf extract. This research is an experimental research. The sample in this study was 25 mosquito mosquitoes *Aedes aegypti* were presented with basil leaf extract concentration of 40%, 50% and 60%, with repetition as much as 3 times using the method of evaporation and spray for 135 minutes. The results showed that the higher concentration basil leaf extract more quickly and more mosquitoes died. In the evaporation method the number of dead mosquitoes were as many as 25 animals with LC<sub>50</sub> minutes 75 concentration of 60%. In the spray method the number of dead mosquitoes were as many as 25 animals with LC<sub>50</sub> minutes to 60 concentration of 50%. This is because the mosquitoes are exposed to extracts of basil leaves contain chemicals such as tannin, eugenol, flavonoids, tripenoid, and essential oil. The conclusion of this study is that the spray method at a concentration of 50% is a more effective method of killing the *Aedes aegypti*. It is expected that the community can utilize the evaporation method and spray using basil leaf extract because it is safe for the environment and humans.

**Keywords:** Evaporation method; spray method; *Aedes aegypti*; basil leaf extrac.

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## 1. Introduction

*Dengue Hemorrhagic Fever* (DHF) is a disease caused by dengue virus belonging to the Arthropod-Borne Virus, genus *Flavivirus*, and family *Flaviviridae*. DHF is transmitted through mosquito bites from the genus *Aedes*, especially *Aedes aegypti* (*Ae. Aegypti*). It can appear throughout the year and can affect all age groups. The occurrence of this disease is related to environmental conditions and behavior of peoples [1].

Various controls have been made in preventing this DHF vector, one of which is the use of chemical insecticides which are considered more effective in killing vectors. Mosquito control can be done by several methods. One of them is to use the evaporation and spray methods using vegetable and synthetic insecticides [2].

Basil leaf has a distinctive aroma, sweet and cold tastes. Its distinctive aroma comes from the leaves. Basil leaf (*Ocimum* sp.) contains active compounds such as flavonoids, saponin, tannins and essential oils [3]. The combination of these active compounds, making basil leaves can be used as bio-insecticides to minimize the toxic effects of synthetic insecticides [4].

## 2. Material And Method

This study was conducted at the Laboratory and the Girls Dormitory of Environmental Health and held in April 2018. The population used in this study was active *Ae. aegypti*. The sample used was 25 *Ae. aegypti*. This is based on the bioassay test, to determine the effectiveness of an insecticide, the number of mosquitoes used is 20-25 [5]. Primary data is data obtained based on the results of preliminary tests that have been done. It is to ascertain whether the evaporation and spray methods can kill *Ae. aegypti*. Secondary data is data obtained from various references such as books, journals, articles and other literature that are considered to support existing theories, and are considered to have relevance to this study. Data processing used in this study was computerized by using Microsoft Word, and Microsoft Excel. The data were presented in the form of tables and Figures.

The type of material used is basil leaves that have been extracted and divided into 3 (three) concentrations, i.e 40%, 50% and 60%. The independent variable is the variable that affects the dependent variable, namely the ability of evaporation and spray methods by using basil leaf extract at a concentration of 40%, 50% and 60% in killing *Ae. aegypti*, on 135 minutes exposure. The dependent variable is the variable that is influenced by the independent variable, namely the death of *Ae. aegypti*. Confounding variables are variables that affect the dependent variable but are not examined, such as temperature, humidity and time.

## 3. Results and Discussion

### 3.1 Results

#### 3.1.1 Evaporation Method

**Table 1:** Observation result of *A.aegypti* post-exposure with basil leaf extract at a concentration of 40% for 135 minutes

Length of Observation (minute)	Total mortality of <i>Aedes aegypti</i> for 135 minute			Average mortality of % mesquite	
	Replication I	Replication II	Replication III		
0	0	0	0	0	0
15	0	0	0	0	0
30	0	0	0	0	0
45	2	3	2	2	8
60	4	5	4	4	16
75	7	7	7	7	28
90	12	11	12	12	48
105	17	15	16	16	64
120	21	20	21	21	84
135	25	25	25	25	100

Based on table 1, it shows that average mortality of *Aedes aegypti* post-exposure with basil leaf extract at a concentration of 40% by evaporation method, at most at 135 minutes, namely 25 mosquitoes.

**Table 2:** Observation result of *A.aegypti* post-exposure with basil leaf extract at a concentration of 50% for 135 minutes

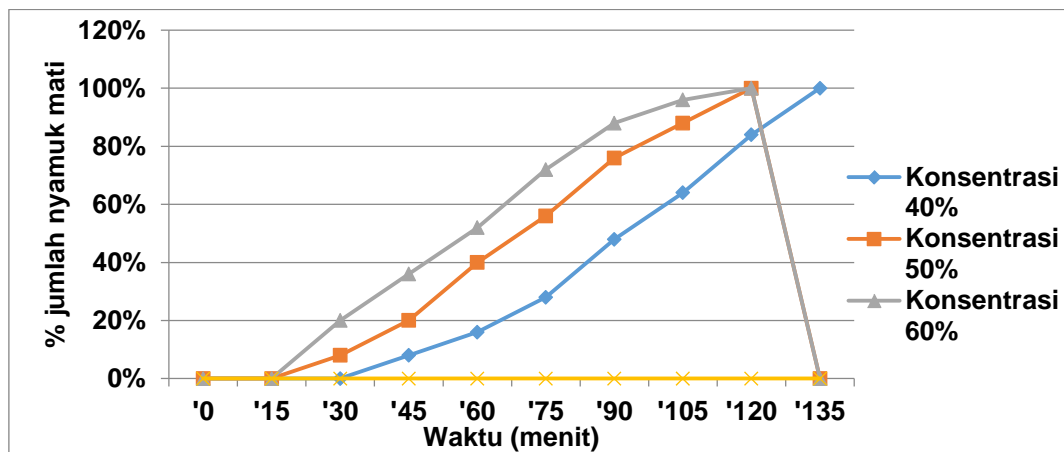
Length of Observation (minute)	Total mortality of <i>Aedes aegypti</i> for 135 minute			Average mortality of % mesquite	
	Replication I	Replication II	Replication III		
0	0	0	0	0	0
15	0	0	0	0	0
30	2	1	3	2	8
45	5	4	5	5	20
60	10	10	9	10	40
75	16	14	13	14	56
90	20	19	19	19	76
105	22	21	22	22	88
120	25	25	25	25	100
135	0	0	0	0	0

Based on table 2, it shows that the average mortality of *Aedes aegypti* post-exposure with basil leaves extract at a concentration of 50% by evaporation method, at most at 120 minute, namely 25 mosquitoes.

**Table 3:** Observation result of *A.aegypti* post-exposure with basil leaf extract at a concentration of 60% for 135 minutes

Length of Observation (minute)	Total mortality of <i>Aedes aegypti</i> for 135 minute			Average mortality of mesquite	%
	Replication I	Replication II	Replication III		
0	0	0	0	0	0
15	0	0	0	0	0
30	4	5	5	5	20
45	9	9	9	9	36
60	12	13	13	13	52
75	17	18	18	18	72
90	21	22	22	22	88
105	23	24	24	24	96
120	25	25	25	25	100
135	0	0	0	0	0

Based on table 3, it shows that the average mortality of *Aedes aegypti* post-exposure with basil leaves extract at a concentration of 60% by evaporation method, at most at 120 minute, namely 25 mosquitoes.



**Figure 1:** Observation result of *Aedes aegypti* post-exposure with basil leaf extract at a concentration of 40%, 50%, 60% and control for 135 Minutes

Based on Figure 1, it shows the number of mortality of *Aedes aegypti* post-exposure with basil leaves extract by evaporation method which has the highest mortality rate at a concentration of 60% and the lowest at a

concentration of 40%.

**3.1.2 Spray method**

**Table 4:** Observation result of *Aedes aegypti* post-exposure with basil leaf extract at a concentration of 40% for 135 Minutes

Length of Observation (minute)	Total mortality of <i>Aedes aegypti</i> for 135 minute			Average mortality of mesquite	%
	Replication I	Replication II	Replication III		
0	0	0	0	0	0
15	2	2	3	2	8
30	5	4	5	5	20
45	9	8	9	9	36
60	13	11	12	12	48
75	15	15	15	15	60
90	17	18	18	18	72
105	21	21	21	21	84
120	25	25	25	25	100
135	0	0	0	0	0

Based on table 4, it shows that the average mortality of *Aedes aegypti* post-exposure with basil leaves extract at a concentration of 40% by spray method, at most at 120 minute, namely 25 mosquitoes.

**Table 5:** Observation result of *Aedes aegypti* post-exposure with basil leaf extract at a concentration of 50% for 135 Minutes

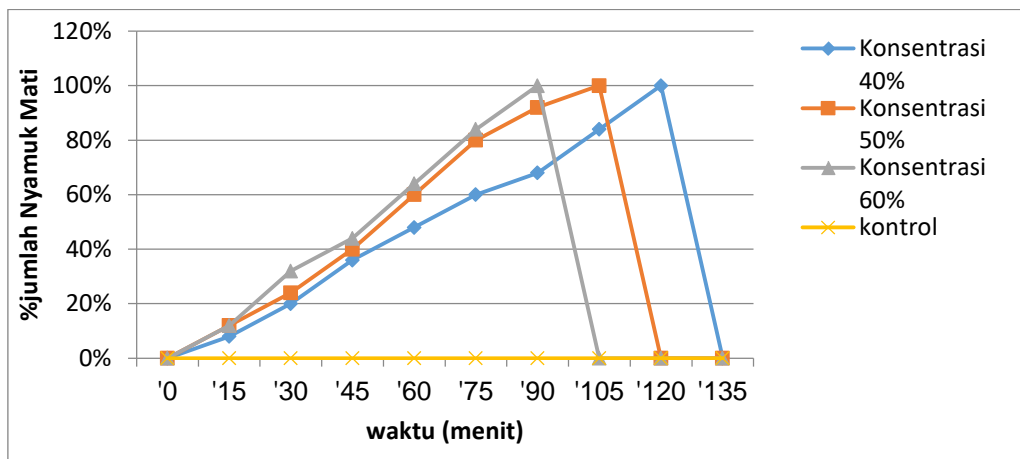
Length of Observation (minute)	Total mortality of <i>Aedes aegypti</i> for 135 minute			Average mortality of mesquite	%
	Replication I	Replication II	Replication III		
0	0	0	0	0	0
15	3	2	3	3	12
30	6	6	7	6	24
45	10	9	11	10	40
60	15	15	16	15	60
75	20	19	21	20	80
90	23	22	23	23	92
105	25	25	25	25	100
120	0	0	0	0	0
135	0	0	0	0	0

Based on table 5, it shows that the average mortality of *Aedes aegypti* post-exposure with basil leaves extract at a concentration of 50% by spray method, at most at 105 minute, namely 25 mosquitoes.

**Table 6:** Observation result of *Aedes aegypti* post-exposure with basil leaf extract at a concentration of 60% for 135 Minutes

Length of Observation (minute)	Total mortality of <i>Aedes aegypti</i> for 135 minute			Average mortality of % mesquite	
	Replication I	Replication II	Replication III		
0	0	0	0	0	0
15	4	3	3	3	12
30	8	8	7	8	32
45	11	11	11	11	44
60	16	17	16	16	64
75	20	21	21	21	84
90	25	25	25	25	100
105	0	0	0	0	0
120	0	0	0	0	0
135	0	0	0	0	0

Based on table 5, it shows that the average mortality of *Aedes aegypti* post-exposure with basil leaves extract at a concentration of 60% by spray method, at most at 90 minute, namely 25 mosquitoes.



**Figure 2:** Observation result of *Aedes aegypti* post-exposure with basil leaf extract at a concentration of 40%, 50%, 60% and control for 135 Minutes

Based on Figure 1, it shows the number of mortality of *Aedes aegypti* post-exposure with basil leaves extract by spray method which has the highest mortality rate at a concentration of 60% in 90 minute and the lowest at a

concentration of 40%.

### 3.2 Discussion

#### 3.2.1 Evaporation method

The concentration of 50% and 60% at minute 15 to 30 the mosquitoes start to step aside to the wall of the cage. It because mosquitoes breathe the aroma of basil leaf extracts containing several chemicals such as tannins, eugenol, flavonide, tripeniod, saponins and essential oils.

The active compounds of flavonoids which are respiratory poisons that enter the body of mosquitoes through the respiratory system, will then cause nerve disorders and damage to the respiratory system, resulting in mosquitoes unable to breathe and eventually causing death in mosquitoes.<sup>5</sup> Evaporation from the basil leaves extract results in compounds the chemicals contained in basil leaf extract enter the body of insect through the respiratory system or trachea which is circulated throughout the body tissues [6].

In evaporation method, the basil leaf extract in 40%, 50% and 60% concentrations has been quite effective because it has met the LC<sub>50</sub> standard. Lethal in concentration 50 is a certain concentration of a material that can kill as much as 50% of experimental animals. So, it can be expressed that basil leaf extract at a concentration of 60% for 60 minutes the mortality of *Aedes aegypti* reached 13 (52%), it considered effective in killing *Aedes aegypti* compared with concentrations of 40% and 50%.

The effectiveness of evaporation method in killing *Aedes aegypti* is due to the presence of several active ingredients contained in the basil leaves so that it can cause death in *Aedes aegypti*. This is in line with the study of Kartika and Isna (2014) where ethanol extract 96% of basil leaves (*Ocimum sanctum* Linn) has larvicidal on third instar larvae of *Ae. aegypti* with LC<sub>50</sub> and LC<sub>90</sub> are 1290.39 ppm and 3173.53 ppm, respectively [7].

#### 3.1.2 Spray method

Aside from being a respiratory poison such as flavonoids, basil leaves also contain other active compounds that are considered to act as insecticides such as tannins which function as contact poisons where insecticides sprayed penetrate the insect integument (*cuticle*) which causes active ingredients to penetrate the insect [8]. Basil leaves also contain essential oil chemical compound. The content for insects can be repellent, attractant, toxic, fumigant, antifeedant, oviposition deterrent, inhibit growth, reduce fertility, and as vector anti-insect [9].

The sprayed residual of basil leaves can last a certain amount of time. At this period, the toxicity of insect is still enough to kill the insects. Thus the use of the spray method is the most appropriate method in this study because it can cover the three toxin properties of this compound [10]. In addition if the compound or extract is used in nature it will not disturb non-target organisms.

The spray method for killing *Aedes aegypti* using basil leaf extract at concentration of 40%, 50% and 60% has been quite effective because it has met the LC<sub>50</sub> standard. Lethal at a concentration of 50% is a chemical that causes 50% of the experimental animals to die. So it can be expressed that basil leaf extract at a concentration of

50% for 60 minutes has been effective in killing *Aedes aegypti*, where the mortality reached 15 (60%) compared to concentrations of 40% and 60% [11]. This is certainly more effective because it is more environmentally friendly and does not cause odor. The effectiveness of the spray method as an effort to control the *Aedes aegypti* is due to the presence of several active ingredients contained in basil leaf extract so that it can cause death of *Aedes aegypti* [12]. This is in line with a study of Indri and his colleagues (2017) showed that basil (*Ocimum basilicum* L.) leaf extract was effective as a bio-insecticide against the death of *Aedes aegypti*. The concentration of basil (*Ocimum basilicum* L.) leaf extract affects the mortality of *Aedes aegypti* with values of LC<sub>50</sub> and LC<sub>90</sub> obtained at concentrations of 41.81% and 101.66% [13].

#### 4. Conclusion

- a. Evaporation method using basil leaf extract is effective at a concentration of 60%, where the average mortality of 25 *Aedes aegypti* has fulfilled lethal concentration in 75<sup>th</sup> minute.
- b. Spray method uses basil leaf extract is effective at a concentration of 50%, where the average mortality of 25 *Aedes aegypti* has fulfilled lethal concentration in 60<sup>th</sup> minute.
- c. An effective method in killing *Aedes aegypti* is spray method at a concentration of 50%.

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