EFFECTIVENESS OF POMELO (*Citrus maxima*) AND LIME (*Citrus aurantifolia*) ORANGE PEEL EXTRACT AS *Aedes aegypti* BIOLARVASIDA

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ABSTRACT

Dengue Hemorrhagic Fever in Indonesia 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 endemic to DHF, from 2 provinces and 2 cities, to 32 (97%) and 382 (77%) districts / cities in 2009 (1). Orange plants with various varieties contain ingredients that can be used as natural insecticides in larvae. This study included the type of experiment with a completely randomized design that was testing the effectiveness of grapefruit peel extract (*Citrus grandis*) and lime (*Citrus aurantifolia*) as *Aedes aegypti* biolarvasida. This research will be conducted at the Mamuju Ministry of Health Polytechnic Building. The time of this study was in March - August 2018. The object of this study was orange peel extract which was exposed to instar III and IV Aedes aegypti larvae. The stages of research activities include making orange peel extract, preliminary test phase and research test phase. The results showed that the number of larval deaths exposed to lime peel extract (Citrus aurantifolia) with an average mortality of 97.3% was effective in killing Aedes aegypti larvae because more than 50% compared to the skin extract of grapefruit skin extract (Citrus grandis) with the average mortality is 1.3% so it is not effective in killing Aedes aegypti larvae because it is less than 50%.

Keywords: extract, orange, peel, aedes aegypti

INTRODUCTION

Dengue Hemorrhagic Fever in Indonesia 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. The number of patients and the area spread increased due to high population mobility, development of urban areas, climate change, changes in population density and distribution and other epidemiological factors that still need further research (1).

The case of 2011 dengue hemorrhagic fever in Mamuju Regency recorded 173 people suffering from dengue and the death was only 1 person. In 2012 the number of dengue cases was recorded by 100 people and 1 died. The highest incidence of cases in the Binanga Health Center area in five kelurahan in a row from 2013 there were 85 cases died 1 person and 2014 as many as 48 people none died. And in 2017 the number of dengue cases in Mamuju Regency was 20 cases of DHF and 1 person died, of which 15 cases of dengue occurred in the work area of the Binanga Health Center (2).

The use of repetitive insecticides can increase the risk of contamination of pesticide residues in water, especially drinking water. Temephos cannot be used orally, so its presence is not expected to be in drinking water. Another important thing to note is the high cost of using chemical pesticides and the emergence of resistance from various species of mosquitoes which become vectors of disease. With the above problems, it is necessary to do research on alternative natural materials to overcome the spread of Aedes aegypti mosquitoes.

The use of natural larvacides has several advantages, including rapid degradation by sunlight, air, moisture and other natural components, thereby reducing the risk of soil and water pollution. Natural larvasida has low toxicity in mammals, so natural larvicidal use allows it to be applied to human life. The choice of material to be used as larvacide must be safe against humans or other organisms, besides that the material is easily obtained and is expected to have a positive impact on human health (3).

One of the development of alternative insecticides is by killing mosquitoes, especially in the larval stage using natural larvicides. With this effort, it is expected that the development of the life cycle will be hampered or disconnected because mosquitoes cannot develop into adults. The results showed that larvacides derived from plant extracts are safe for the environment, can be degraded, and are specific to the target (4).

Orange plants with various varieties contain ingredients that can be used as natural insecticides in larvae. Based on phytochemical screening performed (5) showed that orange peel contains tannins, saponins, phytate oxalates, flavonoids, and limonoid. Limonoid has the ability to inhibit

the formation of cancer cells, reduce the formation of low-density lipoprotein (LDL) and based on field tests conducted on insects, limonoid is able to inhibit insects to eat (anti-feedant) (6). Lime (Citrus aurantifolia) is a plant from the Rutaceae family that has the potential to produce essential oils, one of which is on the skin of the fruit (7).

Lime fruit extract (Citrus aurantifolia) has the ability to kill instar III Aedes aegypti mosquito larvae. The effective concentration of lime peel extract (Citrus aurantifolia) which can kill 50% (Lc50) of Aedes aegypti mosquito larvae is 3.42% within 24 hours (8). Larvacidal effect of ethanol extract of the leaves of Bali Citrus (Citrus maxima) on Aedes aegypti larvae and knowing the relationship between the increase in the concentration of ethanol extract of Bali Citrus Leaves (Citrus maxima) and larval mortality. LC50 and LC90 values of ethanol extract of Bali Citrus leaves (Citrus maxima) were 7,913.33 ppm and 20,069.53 ppm respectively with a difference of LC50 and LC90 of 12,156.2 (9). For this reason, a study will be conducted on the Effectiveness of Bali Citrus Maxima and Lime (Citrus aurantifolia) Extract as Aedes aegypti Biolarvasida.

METHOD

This study included the type of experiment with a completely randomized design design which tested the Effectiveness of Pomelo (Citrus maxima) and Lime (Citrus aurantifolia) Orange Peel Extract As Aedes aegypti Biolarvasida ".

This research was conducted at the Mamuju Kalukku Poros Health Polytechnic Integrated Laboratory in Jalan Mamuju Kalukku Km.16 Tadui, West Sulawesi. The time of this study is planned, namely in March - August 2018

The object of this study is extract of Bali Citrus Skin (Citrus maxima) and Lime (Citrus aurantifolia) which will be exposed to instar III and IV Aedes aegypti larvae.

This study uses the infundation method (10). By preparing samples to be used, namely lime peel, grapefruit peel and sweet orange peel. Weighing the weight of each material with the ratio of weight of material and water is 1:10. The powdered material is heated in a pan with enough water for 15 minutes starting from the temperature reaching 90^{o}C chili stirred once in a while. Filter using a flannel cloth while hot, if the amount of liquid needed is still lacking add hot water to the pulp until the amount of liquid needed is fulfilled. After the liquid is cold, put it in the sample bottle and then insert 25 and IV instar larvae as many as 25. Observations were carried out for 24 hours, with observations every 8 hours, namely 8, 16 and 24. Record the observations, do repetitions 3 times.

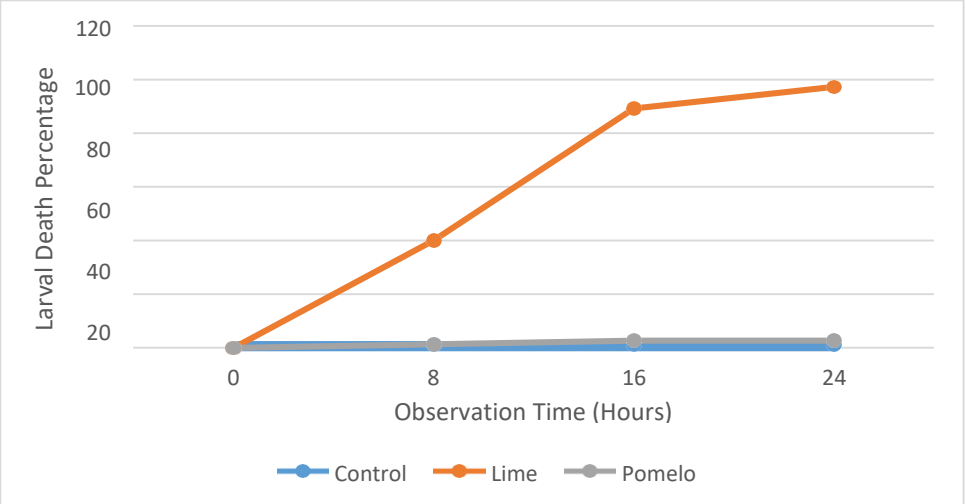
RESULTS

Based on the results of research conducted at the Mamuju Ministry of Health Polytechnic Integrated Laboratory, 24-hour observations were observed for three observations, namely 8, 16 and 24 hours in a solution of Bali Citrus Skin (Citrus maxima) and Lime (Citrus aurantifolia).

Table 1 Distribution of Average Value of Death of Aedes aegypti Larvae based on Treatment Type and Exposure Time

Orange Peel Extract	Average larval mortality (3 x repetitions) based on exposure time (SD)			
	Time (on the hour)			
	0	8	16	24
Control	0 (0,000)	0,33 (0,577)	0,33 (0,577)	0,33 (0,577)
Lime(*Citrus aurantifolia*)	0 (0,000)	10 (4,000)	22,33 (2,309)	24,33 (0,577)
Pomelo (*Citrus maxima*)	0 (0,000)	0,33 (0,577)	0,67 (0,577)	0,67 (0,577)

In table 1 above shows that the average number of deaths of Aedes aegypti larvae at 24th hour is the largest in the solution of lime skin extract as many as 24.33 larvae while the smallest number of mortality of larvae in the solution of grapefruit skin extract is 0.67 tails larva.



Graph 1. Percentage of Larva Death In Graph 1 above shows that lime extract can kill aedes aegypty larvae> 50% at the 16th observation time with an average mortality of 89,3%.

Table 2 Mortality Rate Distribution in Some Treatments of Orange Peel Extract

Orange peel extract solution	Repetition			Mortality Rate (%)
	y			
	I	II	III	
Lime (*Citrus aurantifolia*)	24	24	25	97,3
Pomelo (*Citrus maxima*)	1	0	1	1,3

In table 2 above shows that the biggest mortality rate of the three treatments is a solution of lime peel extract with a mortality rate of 97.3%. The lowest mortality rate is a solution of grapefruit skin extract with a mortality rate of 1.3%.

DISCUSSION

The results of laboratory tests obtained the highest results, namely 97.3%, the average mortality of larvae occurred in larvae exposed to lime skin extract and the lowest was larvae exposed to grapefruit extract with an average mortality rate of 2.7% for 24 hours of observation . And the higher the concentration and duration of exposure given, the greater the mortality of Aedes aegypti larvae (11). The chemical compounds in orange peel are flavonoids, carotenoids and liminoids (6). In addition, orange peel also contains saponins and tannins (5). Saponins have the effect of disrupting the developmental stage and disruption of the change of larval skin (12).

Limonen or limonoid is one of the essential oil compounds which has the potential as larvacide. As a stomach poison, limonoid can enter the body of Aedes aegypti mosquito larvae. Enter the digestion by immersing the ingested extract concentration. Insecticides will enter the digestive organs of the insect and be absorbed by the intestinal wall then circulate with blood which will disrupt the body's metabolism so that it will lack energy for its life activities, resulting in mosquito larvae spasm and eventually death (13).

The results of the Krusskal-Wallis test showed that there were significant differences in the mean mortality of larvae according to the type of orange extract solution with a probability value of 0.026.

Citrus plants are one of the essential oils producing plants. The essential oils produced by citrus plants contain mostly terpenes, aliphatic sisquiterpenes, oxygenated hydrocarbon derivatives, and aromatic hydrocarbons. Composition of compounds contained in essential oils produced from the fruit peel of the plant of the Citrus genus based on the research carried out include limonen, citronelal, geraniol, linalol, α-pinen, mirsen, β-pinen, sabinen, geranil acetate, nonanal, geranial, β-karyophilene, and α-terpineol (14).

Essential oils produced from citrus plants have the potential as natural insecticides which can be used as mosquito controllers (15). Insecticides produced from a plant can kill mosquito larvae, adult mosquitoes, or protection against mosquito bites (16). There are three components of chemical compounds that make up the essential oils of grapefruit peel namely limonen (93.99%), β-pinene (3.20%), and germacren-D (2.82%) (17). The total compounds in the essential oils of lime (C. Aurantifolia) are amounted to 18. These compounds include limonen (33.33%), β-pinene (15.85%), citral (10.54%), minerals (7, 94%), γ- terpinene (6.80%), α-farnesen (4.14%), α-bergamoten (3.38%), β-bisabolen (3.05%), α-terpineol (2, 98%), linalol (2.45%), sabinen (1.81%), β-elements (1.74%), nerol (1.52%), α-pinen (1.25%), geranil acetate (1.23%), 4-terpineol (1.17%), neryl acetate (0.56%) and trans-β-osimen (0.26%) (18). The content of the essential oils of sweet orange skins are the 2 biggest components, namely Limonene (96.69%) and the other component is Pinene (3.31%) (17).

Based on the results of research conducted, all citrus peels extracted the mortality of Aedes aegypti larvae. The most effective orange peel extract from the death of Aedes aegypti larvae was lime peel extracted with an average mortality of 97.3% in 24 hours with repetitions of 3 times. This might be caused by the content of essential oils, namely β-pinene which is found in the lime peel greater than sweet orange and grapefruit. The content of β-pinene in time code is 15.8% (18) and the β-pinene content in grapefruit is only 3.20% (19). The larval mortality that is considered to play a role as a larvacide against aedes aegypti (20). Another study also stated that β-pinene in turpentine functions as the main component of larvacide and the dose of LC50 β-pinene as larvacide is 35.9 ppm (21).

The use of lime can be applied in the community as an alternative to controlling vector causes of DHF. The use of lime peel as larvacide is safer, it is also environmentally friendly, does not cause harm, and has other advantages which are easy to obtain and can reduce the amount of waste / organic waste, because it is so far Lime (Citrus aurantifolia) is just thrown away without further use.

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