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Bio larvicidal Activity of Noni Leaf and Ylang Flower Infusion on the Death of Aedes aegypti Larvae

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Abstract. Dengue Hemorrhagic fever (DHF) is caused by a dengue virus that spreads through the bite of the Aedes aegypti mosquito, which breeds a lot in densely populated areas with humid and warm climates. Anti-mosquito drugs in the form of burns, sprays, lotions, or other types are already widely used, but these anti-mosquito drugs are not entirely beneficial. This research is purely experimental research with Post-test Only Control Group Design by making air spray solution products from noni leaf infusion and cananga flower, which are analyzed descriptively and analytically. Experiments carried out with Randomized Complete Design 1 time repetition to analyze effectiveness. The study used two factors: treatment (P) using infusion products while the control (K) using distilled water. From the results of mixing, it was obtained as much as 400 ml of infusion solution. Obtained in each measurement, there was a reduction in live larvae until the last measurement. Noni leaf contains five flavonol glycosides (flavonoid compounds) as respiratory poisons and a combination of saponins and tannins as stomach poisons that have the killing power against the death of Aedes aegypti larvae. Cananga flower extract itself can resist mosquitoes because of the content of linalool, geraniol and eugenol. This makes a change in the larvae's behavior, where the previously active movement will be slow and eventually will die.

Keywords: *airspray solution, infundation, Noni leaves, Cananga flowers, flavonoid, larvacide, Dengue Hemorrhagic Fever, Aedes aegypti, anti-mosquitoes.*

1. Introduction

The 2030 Sustainable Development Goals (SDGs) or which translates to Sustainable Development Goals are a comprehensive vision issued by the United Nations (UN) to achieve a better world in 2030. The Sustainable Development Goals (SDGs) are a follow-up program from the MDGs which ended in 2015, consisting of 17 goals and 169 specific targets. One of them is the 3rd goal which is to ensure healthy lives and promote well-being for all people at all ages. In details there are 13 targets, where the third target mentions that by 2030 end the epidemics of AIDS, tuberculosis, malaria, hepatitis, water-borne diseases, infectious diseases, and eradicate neglected tropical diseases such as Dengue Hemorrhagic Fever (DHF) caused by mosquito as the vector (Bappenas, 2015).

Dengue Hemorrhagic Fever (DHF) or dengue fever is a severe disease known by the public as dengue fever which can make the patient's body temperature very high, usually accompanied by headaches, joint, muscle and bone pain, and pain behind the eyes. This disease is caused by the dengue virus which is spread through the bite of the Aedes aegypti mosquito. These mosquitoes breed in densely populated areas with warm, humid climates. Indonesia is a country with a tropical and humid climate, where the prevalence of dengue fever is high (Setiati, et al., 2014).

Based on the number of sufferers of dengue fever in the world, Indonesia ranks number 2 after Brazil (WHO, 2010). Based on the records of the World Health Organization (WHO), an estimated 500,000 DHF patients require hospital care every year. This disease is included in the top ten causes of hospitalization and other health facilities and death in children in at least eight tropical countries in Asia, including Indonesia. This condition

makes Indonesia the number one country in Southeast Asia regarding cases of dengue fever. In 2013 (Ministry of Health RI, 2013) there were 112,511 cases of dengue fever in 34 provinces in Indonesia, and 871 patients died. In 2014, cases of dengue fever in Indonesia have decreased. Until mid-December 2014 there have been 71,668 cases with 641 people who died. (Kemenkes RI, 2014). In 2017, there were 52,199 cases of dengue fever with 523 people who died (RI Ministry of Health, 2017).

The Ministry of Health of the Republic of Indonesia has initiated many programs to anticipate dengue fever. The 3M program (closing, draining and burying) in bathtubs and stagnant water as a breeding ground for Aedes aegypti mosquito larvae, and spreading Abate powder into bathtubs has been implemented in Indonesia for quite a long time. Basically, these efforts have not resulted in a significant reduction in the morbidity rate of dengue fever, although efforts are always made to reduce it from year to year. In this case, it is hoped that there will be natural products from traditional plants that can be used as medicine to anticipate dengue fever by breaking the chain of mosquito bites or the breeding of mosquitoes, especially Aedes aegypti (Ayu, 2010).

Many attempts have been made to kill or avoid mosquito bites, such as using mosquito repellents in the form of fuel, spray, lotion or other forms, but these mosquito repellents are not entirely profitable. Most of the products have a risk of danger to humans and the environment due to the use of toxic products contained in mosquito repellents. Examples of classes of hazardous chemicals that are often used in mosquito repellents are carbamates (eg propoxur), pyrethroids (eg permethrin), organophosphates (eg DDVP or Dichlorovinyl Dimethyl Phospate, and DEET or diethylmetatoluamide), and organochlorine groups. The use of chemical mosquito repellents can leave residues, pollute the environment, and can lead to resistance. The residue left behind can cause health problems such as skin irritation, even if absorbed in high doses it can cause muscle spasms. In addition, if it is inhaled and enters the respiratory tract, for a long time it can cause changes and damage to the tissues that make up the airways which can later interfere with the respiratory system. According to WHO, one of the triggers for asthma and cancer in the airways is anti-mosquito drugs (Dahniar, 2011; Aini, et al., 2016; Utomo and Nana, 2014).

Noni leaves contain flavonoids and phenolics, which act as antioxidants, anticancer, and antiseptic while ylang flower extract itself has the ability to repel mosquitoes due to the content of linalool, geraniol, and eugenol. Therefore, researchers are motivated to make an airspray solution product from noni leaf infusion and ylang flowers to be poured into the bath as a substitute for abate powder in order to reduce the prevalence of Dengue Hemorrhagic Fever caused by the Aedes aegypti mosquito vector.

2. Methods

This research is purely experimental research with a Post-test Only Control Group Design by making an air spray solution product from noni leaf and Ylang flower infusion, the results of which were analyzed descriptively and analytically. The experiment was conducted in a completely randomized design to analyze the effectiveness. The study used 2 factors, namely the treatment (P) used infusion products while the control (K) used distilled water. This research was carried out from 23 May 2020 – 30 June 2020 at Tambun Tulang Hilie, Kenagarian IV Koto Hilie, Batang Kapas District. The population of this study were Aedes aegypti mosquitoes in buckets. The sample in this study were Aedes aegypti mosquito larvae. This study used observation and time measurement methods on objects to determine the effectiveness of infusion killing power against Aedes aegypti mosquito larvae. The tools needed in this study were pots, gas stoves, filters, spray bottles as

containers, measuring cups, scales, and pipettes. The materials used in this study were noni leaves and ylang flowers taken from IV Koto Hilie, mineral water, and salt as a preservative. The calculation of the length of time the larvae were observed started from when the infusion of noni leaves and Ylang flowers was put into a bucket containing the treatment object until the time when all the larvae died was obtained.

3. Results and Discussion

From the mixing results, 300 ml of infusion solution was obtained which was then tested into a bucket containing mosquito larvae. Testing the duration of larval death was carried out every 15 minutes in the two control groups. It was found that in each measurement there was a reduction in larvae that lived until the last measurement. Meanwhile, in the control group treatment using distilled water, no larvae mortality was found. The death of Aedes aegypti larvae occurred linearly with the addition of infusion solution from noni leaves (Morinda citrifolia) and Ylang flowers (Cananga odorata) and inversely proportional to the addition of distilled water as a control where no larvae died.

Aquades did not have a larvicidal effect which caused death in the test larvae. This happens because distilled water (water) is the habitat of Aedes aegypti mosquito larvae and does not contain toxic substances (Heriyanto, et al 2011). In addition, distilled water has a pH of 7 which is the optimal development site for Aedes aegypti mosquito larvae (Sukamsih, 2006). The death of mosquito larvae against treatment proved that this material was effective as a natural larvicidal. Deaths in the test group began to occur in the 15th minute and continued to increase until all of them died in the 60th minute.

This is in line with previous studies, noni leaf extract can kill Aedes aegypti larvae because of the compounds it produces through the phytochemical screening test, namely essential oils, saponins, triterpenoids, phenols, tannins and glycosides (Aryadi, 2014) due to the cyanide, saponin, tannin groups, flavonoids, essential oils, and steroids are compounds in plants that are proven as larvicides (Untung, 2006). Meanwhile, tannin compounds that are also soluble have the ability to reduce the activity of digestive enzymes so that the larvae experience nutritional disorders (Dinata, 2009). Meanwhile, the flavonoids contained in noni leaves work as a respiratory poison which causes damage to the respiratory system and wilting of the nerves (Cania and Endah, 2013).

Morinda citrifolia is a hard-stemmed and woody plant with many branches which contain many chemical substances in every part of the plant. Especially the leaves contain flavonoids, calcium, protein, iron, carotene, arginine, glutamic acid, tyrosine, ascorbic acid, ursolic acid, thiamin, glycosides, resins, and anthraquinones (Rukmana, 2002).

According to Sibi (2012) the highest larvicidal compounds in noni plants are found in the leaves rather than the stems and fruits. After conducting a skin sensitivity test of noni leaf extract on 25 volunteers in a previous study (West, 2009) said that there were no allergic reactions or irritation. According to Suparjo (2008) saponins are secondary metabolites whose properties resemble soap and can dissolve in water with their anti-insect effects. Saponins are compounds in the form of steroidal glycosides or triterpenes which taste bitter and foam when shaken with water. Saponins have various biological properties such as hemolytic ability (Oda et al., 2000; Woldemichael & Wink, 2001), antibacterial activity (Avato et al., 2006; Hassan et al., 2007), antimollusc (Huang et al., 2003), antiviral activity (Gosse et al., 2002), cytotoxic or anti-cancer activity (Kuroda et al., 2001; Yun, 2003; Agarwal, 2016), hypocholesterolemic effects (Singh & Basu, 2012) and antiprotozoa (Delmas et al., 2000; Mshvildadze et al., 2000).

While tannins are present in various woody and herbaceous plants, they act as a plant defense by blocking insects from digesting food. Insects that eat plants with a high tannin

content will get little food and decreased growth (Howe & Westley; 1988). The Ylang plant (Cananga odorata), which is a child of the Annonaceae (ylang-ylang) class, has a double flower decoration that can be distinguished between the petals and petals, as well as the corolla (Suharti, 2015). The star-shaped flowers with a yellow color when ripe smell good and can produce essential oils which have many benefits and are relatively safe (Hatta, 1993). There is no reference that says that ylang oil has indications of causing allergic reactions (Burdock, 2008). Alcohols, esters, ethers, phenols, aldehydes, and sesquiterpene hydrocarbons are the general chemical compositions found in this flower (Bucellato, 1982) which are often used by the pharmaceutical, cosmetic, food mixtures and even as a fragrance ingredient. Not only that, according to Amalia et al. (2013) said that ylang ylang oil also contains antioxidant compounds: hydroxyl, peroxyl, akyl which can capture free radicals (Amalia et al, 2013).

Dengue Hemorrhagic Fever (DHF) or better known as dengue fever is an infectious disease caused by the dengue virus which belongs to the genus Flavivirus, family Flaviviridae. This virus has four serotypes, namely DEN-1, DEN-2, DEN-3, and DEN-4, with DEN-3 being the most common serotype found in Indonesia. Mosquitoes of the Aedes genus, especially A. aegypti and A. albopictus, are vectors that transmit the dengue virus (Setiati, et al., 2014). The Aedes aegypti mosquito, which is spread throughout Indonesia, has a black body with white stripes on its head, thorax and abdomen. Because the main host is humans, the Aedes aegypti mosquito will suck human blood every day, especially during the day (diurnal) (RI Ministry of Health, 2011). After biting the Aedes aegypti mosquito, it needs time to rest, such as in a dark place, where clothes are hung and in piles of things. Mosquitoes that have a flight distance of 500-100 meters like to lay their eggs in stagnant water where there is no soil (Puspawati et al., 2009).

Typically, the black, oval-shaped eggs are laid along the waterline in man-made water reservoirs such as bathtubs, jars, drums, flower vases, and all kinds of waste items that can collect rainwater. After becoming a larva, its position will form an angle to the surface of the water, but when its position is threatened, the larvae will quickly move to the bottom and stay there for several minutes (RI Ministry of Health, 2011).

Diagnosis of Dengue Hemorrhagic Fever (DHF) is based on WHO 1997 criteria, namely if there is a history of fever, thrombocytopenia, a decrease in hematocrit of more than 20%, and signs of plasma leakage, as well as the occurrence of bleeding such as bleeding in the mucosa (gums or epictasis, hematemesis or melena, etc (Setiati, et al., 2014). Population growth and rapid population mobilization, inadequate housing and improper waste disposal, as well as community education and employment are risk factors for Dengue Hemorrhagic Fever (DHF) transmission (Candra, 2010).

In addition, the workings of the chemical compounds contained in noni leaves, namely stomach poisoning, can disrupt the digestive system of Aedes aegypti larvae, causing them to fail to grow and end up dying. This stomach poison attacks the main digestive organs of insects, namely the ventricles. The ventricles are part of the food channel as a place for absorption of food juices. Insecticides that are absorbed along with food extracts will then be distributed to all parts of the insect's body by hemolymph (Suyanto, 2009). The content of chemical compounds in Ylang flowers, especially in essential oils, consists of flavonoids and saponins. Flavonoids are a group of phenols which can cause protein clumping (Syahputra, 2006). Meanwhile, according to Dinata (2006), flavonoids are one of the compounds that are toxic. Flavonoids have distinctive properties, namely a very sharp odor, can dissolve in water and organic solvents and easily decompose at high temperatures.

Ylang flower extract has the ability to repel mosquitoes due to the presence of linalool, geraniol, and eugenol. The essential oil contained in Ylang flower extract seeps into the

pores and then evaporates into the air. This odor will be detected by chemical receptors (chemoreceptors) found in the mosquito's body and leads to nerve impulses. That is then translated into the brain so that the mosquito will express to avoid without sucking blood again. The more active ingredients contained in Ylang flower extract, the greater the ability of the extract to repel mosquitoes (Ministry of Agriculture, 2019). In another study, the main component that gives rise to the characteristic aroma of Ylang oil is linalool, which is a compound from the oxygenated monoterpene group. In addition, the content of bioactive compounds such as sesquiterpenes which are used as pharmaceutical ingredients or have health benefits indicates that this Ylang can be used as a natural antioxidant because of the many useful compounds it contains (Pujiarti, et al., 2015).

4. Conclusions

There were differences in the mortality rate of Aedes aegypti mosquito larvae with the addition of noni leaf and Ylang flower infusion in buckets and compared between the two control groups. After observing and considering the literature review used, this solution proved to be effective as a natural larvicide against the main vector of Dengue Haemorrhagic Fever, namely the Aedes aegypti mosquito. It is recommended for further research in order to determine the optimal dose by increasing the number of control groups from various concentrations. And removes the colour given by the air spray solution from this infusion so that it is more attractive to look at and can be commercialized as a natural larvicide that is not harmful.

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