The Potential of Temephos as Larvacide for Malaria Vector Control in Katibung Subdistrict, South Lampung

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Abstract. Lampung is one of provinces in Indonesia which still has malaria endemic areas in several subdistricts, including South Lampung District. In this subdistrict, the API recorded 0,212 in 2018 while in 2019 it decreased to 0,103. However, the potential of transmission still occurs due to the presence of extensive lagoons, swamps and puddle along the coast which support the proliferation of malaria vector in that area, one of which is Rangai Tri Tunggal Village, Katibung Subdistrict South Lampung. The purpose of this research is to find out the potential of temephos as a larvacide towards *Anopheles* sp. Mosquito larvae in Rangai Tri Tunggal Village, Katibung Subdistrict South Lampung District. The research used a quasi-experimental design by giving 1g/10 L of temephos to *Anopheles* sp. larvae at 10 breeding points of *Anopheles* sp. in Rangai Tri Tunggal Village, Katibung Subdistrict South Lampung started from August to September 2019. Larva density observations were carried out before and after the administration of temephos (day 21). The data analysis was administrated by using paired T-test. The result of the research showed that there is a significant difference (P<0,01) in the density of larvae before (23,8 heads/scoop) and after giving temephos (2,5 heads/scoop). The temperature at the sampling location ranged about 26-28^{o}C with salinity 20 ppt, the types of aquatic plants are kale, mangroves, and water hyacinths and types of aquatic animals are fish, dragonflies and small snails. The conclusion is that temephos is worth to be considered as a larvacide for malaria vector control at Katibung Subdistrict South Lampung.

Keyword: Temephos, Larvacide, *Anopheles* sp. Larvae, South Lampung

1. Introduction

Malaria is a disease which caused by protozoa from the *Plasmodium* genus. The causes of malaria in humans are *P.malariae*, *P.vivax*, *P.falciparum*, *P.ovale*, and *P.knowlesi*. The transmission of this disease is carried by female *Anopheles* sp. mosquito. Apart from mosquito bites, malaria also can be transmitted through blood transfusions or contaminated syringes and pregnant women to their babies [1].

The Plasmodium which is carried by mosquito bites will live and reproduce in human red blood cells. This disease attacks all age groups both men and women. People who affected by malaria will experience some symptoms such as fever, chills, sweating, headache, nausea or vomiting. Generally,

the patients who show clinical symptoms must undergo the laboratory test to confirm their positive status of malaria [2].

In Lampung Province, this disease still becomes one of health problems because of the presence of endemic areas. The API (*Annual Parasite Incident*) which has been confirmed during 2015-2018 tends to decline, although in 2017 it increased again. The API value is below the expected target which is less than 1 per 1.000 population [3]. Malaria morbidity rate in a certain area is determined by API (*Annual Parasite Incidence*) per year. API is the number of positive cases of malaria per 1.000 population in one year [2]. Data from Lampung Provincial Health Office in 2018 states that South Lampung Districtis a low malaria endemic area.

South Lampung District with area of approximately 2.008,01 km is one of 15 cities in Lampung. South Lampung District which is located between 105º 14' - 105º 45' BT and 5º 15' - 6º LS, is a tropical area which has two seasons namely the dry and rainy seasons. The southern part of South Lampung District which is located at the tip of Sumatra Island has a crossing port named Bakauheni which functions as a gateway for the southern part of Sumatra Island. The distance between Bakauheni Port (South Lampung) and Merak Port (Banten Province) is approximately 30 kilometers with ship travel time crossing about 2-3 hours. In the north, it is bordered by Centre Lampung and East Lampung District. In the east, it is bordered by Sunda Strait while the south part is bordered by Bandar Lampung City and Pesawaran District and the west is bordered by Java Sea. Besides its land area, South Lampung District also has an area which is formed by islands such as Anak Krakatau Island, Sebesi Island, Sebuku Island, Legundi Island, Siuncal Island, Rimau Island and Kandang Island. Administratively, South Lampung District has the capital in Kalianda, consisting 17 subdistricts with 256 villages[4].

Most of sub-districts in South Lampung District are the districts with low malaria cases. One of villages in Katibung subdistrict South Lampung which included in HCI (*High Case Insidence*) category is Rangai Tri Tunggal Village. Many beaches, lagoons and used former pond around the village which has the potential as a breeding area of *Anopheles* sp. larvae thus making the cause of malaria endemicity.

Some of efforts to control the malaria that have been done are in the form of host, agent and environmental based controls. Host based control (humans and mosquitoes). The use of mosquito nets, household insecticide, gauze instalment, the use of repellent and body covering are included in human-based control. Meanwhile, mosquito-based control can be carried out by chemical, mechanical, physical, biological, genetic and legislative control. Then, control of agent can be done by examining the blood of malaria endemic population. Modification and manipulation environment can be said as environmental control [5].

To control this vector growth, the use of insecticides as a larvacide become the most commonly used method by the society. Temephos is an insecticide that is often used in Indonesia. It has been used in Indonesia since 1967. In 1980, temephos 1% (abate) was designated as *Ae.aegypti* mass eradication program in Indonesia. It can be estimated that the use of temephos has been more than 30 years. However, the use of temephos repeatedly can increase the risk of contamination of pesticide residues in the water, especially drinking water [6]. The purpose of this research is to find out the potential of temephos as a larvacide towards the larvae of *Anopheles* sp. mosquito in Rangai Tri Tunggal Village, Katibung Subdistrict South Lampung.

2. Materials and method

The research used a quasi-experimental design in the form of giving 1 g/10 L of temephos to *Anopheles* sp. larvae at 10 breeding points of *Anopheles* sp. with 10 hops for each point. The research was conducted in Rangai Tri Tunggal Village, Katibung Subdistrict South Lampung District from August to September 2019.

The initial survey was administered in order to determine the location. In choosing the location, it is based on the data of endemic malaria cases in recent years and Lampung Provincial Health Office. After finding the location, the next step is determining 10 breeding points of *Anopheles* sp. Then, calculating the density of *Anopheles* sp. larvae before giving the treatment. Next, administering the treatment in the form of giving 1g/10L temephos by wrapping it in gauze and hanging it around the

Anopheles sp. larvae breeding points. The aim of hanging application is to avoid the temephos being buried under the pond. The last stage is calculating the density of *Anopheles* sp. larvae for each breeding points after 21 days of treatment. *Anopheles* sp. larval density determination were taken from the pond by using a dipper. Next, the larvae in the chop were poured into a stray and the researcher calculated the density rate. The sample were taken 10 times repetition from each observation points [7]. Finally, to analyze the result, paired T-Test was administered by the researcher.

3. Result and discussion

The result of analysis in this study can be seen from Figure 1 below which shows the potential of using temephos as a larvacide after 21 days of treatment.

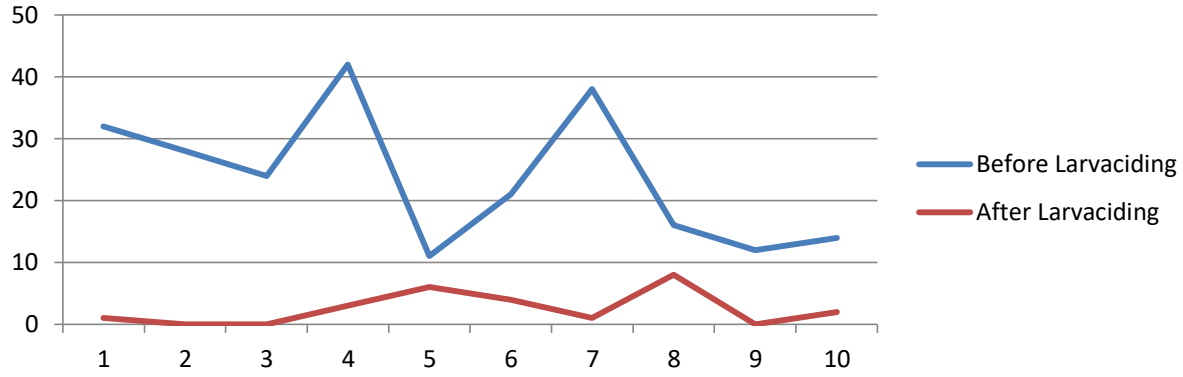

Figure 1. The Result of *Anopheles* sp. Larvae Density Observation

From Figure 1 above, it can be seen that there is a significant difference before and after giving temephos to the sample. After being analyzed by using paired t-test, it is found that the significance level is p=0,00037 (p<0,01) which means that the temephos affected *Anopheles* sp. larvae.

Apart from the observation of *Anopheles* sp larvae density at the breeding location, the researcher also did an observation towards the supporting parameter of the water quality, plants and animals as well as the sun's radiation around the location. The observation result can be seen in Table 1 below.

Tabel 1.The Observation Result at *Anopheles* sp. Larvae Breeding Location

Water Temperature	Salinity	Aquatic Plants	Aquatic Animals	Sunlight
26-28^{0}C	20 ppt	Kale Mangroves Water Hyacinth	Fish Small Fish Snails Dragonflies	Direct sunlight

In a study that conducted by Faraj *et al* (2010) temephos was used in controling malaria in Maroko based on the susceptibility test which the result showed that *Anopheles labranchiae* larvae is still susceptible to temephos even though they still consider the environmental factors, the use of fish which eat mosquito larvae and the use of microbes as biological control [8].

Tabbabi A dan Dasboud J (2018) reported that *Anopheles labranchiae* larvae in Tunisia are already resistan to temephos [9]. According to a research by Florensia in 2010, it was stated that the death occured because the larvacide of temephos was classified as an organophospat compound which has anticholinesterase action which inhibited the cholinesterase enzym, causing disturbances in nerve activity due to the accumulation of acetylcholine at the nerve [6]. The temephos has rapid penetration

which followed by unrest, hyperexcitation, tremor and convulsions also muscle paralysis in the testing pupa. The insecticide with temephos as active ingredients function as contact-poison where the insecticide will enter the mosquito's body through exoskeleton to the insect's body by tarsus at the rest. Over the time, the accumulation of insecticides that enter the mosquito's body will cause death. In addition, temephos can also act as respiratory poison by entering the insect's body in the form of micro particles floating in the air then entering it from respiratory system which caused the insects are unable to breath and die eventually [10].

One of the advantages of using temephos properly is it will be very effective to control mosquito larvae. In addition, it can also be the first line defense against diseases which is caused by mosquito. The use as directed will not cause residual and it is low toxicity [11].

The using application of temephos in a pond was carried out by wrapping it with gauze and hanging it around the breeding points. This is in accordance with the suggestion from health worker to cover it with plastic or gauze and to be perforated because of the residual effect up to three months. Beside that, the function of wrapping the temephos is to avoid being buried in a mud in the bottom of the pond. The weakness of wrapped temephos is it will be forgotten when the expiration period is up (three months) because the package is located in the water storage container. Basically, the use of temephos both of wrapping and spreading it will be effective if it is done correctly by giving the appropriate dosage and replacing it every three months [11].

The use of abate as a larvacide also has a drawback if the dose is increased continuously. It will endanger public and environment health. If the dose is increased, this organophospate group will cause high toxicity both to the mosquito larvae and to humans if exposed directly by abate like ingested. If it happens it will cause poisoning.

4. Conclusion

Temephos has the potential as a larvacide which is worth to be considered as malaria vector control in Katibung Subdistrict South Lampung District.

5. Suggestions

Further research is needed regarding to the effect on non-target organisms, besides the use of microbial control agents and insect growth inhibitors which considering the effectiveness and biochemical and molecular studies to identify the involved mechanism in temephos resistance.

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