OPEN ACCESS
Haya: The Saudi Journal of Life Sciences
Abbreviated Key Title: Haya Saudi J Life Sci
ISSN 2415-623X (Print) |ISSN 2415-6221 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com/sjls

Original Research Article

Effectiveness of Temephos Larvasides on Mosquito Aedes Aegypti in the Airport Buffer and Poso Seaport Buffer Region Poso District Center Sulawesi

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DOI: 10.36348/sjls.2020.v05i07.001 | **Received:** 04.07.2020 | **Accepted:** 19.07.2020 | **Published:** 21.07.2020

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Abstract

This study aims to analyze the effectiveness of temephos against Aedes aegypti larvae in the Buffer Airport and Poso Sea Port area. This type of research is quasi-experimental. The research sample used the first-generation instar Fed 1 Aedes aegypti larvae obtained from mosquito breeding. A total sample of 240 tails consisted of treatment and control with 3 replications each. Testing uses 1% temephos concentration. The statistical test used in univariate and probit analysis. Based on the results of the study showed that the Poso Airport Buffer, Aedes aegypti test larvae were susceptible to temephos 1% with a total mortality of 100% of the test larvae. where the WHO standard criteria state for larvae of the test 98-100% Vulnerable, 80-98% Tolerant deaths, and <80% resistant. Likewise, with the Poso Port Buffer region, the Aedes aegypti test larvae are susceptible to temephos 1% with a total of 100% average adult mosquito mortality. the overall lethal time values (LT50, LT90, LT95, LT99) in the Poso Sea Port Buffer region are higher than in the Poso Airport Buffer area, where the Poso Sea Harbor Buffer area for 1% temephos requires a longer time to kill the Aedes aegypti test larvae, compared to the Poso Sea Port Buffer region. by poso airport. Especially to kill 99% of test larvae in the Poso Sea Port Buffer region, temephos 1% takes 147.2 minutes or 2 hours 27 minutes while for the Poso Airport Buffer region it only takes 119.86 minutes or 1 hour 59 minutes to kill 99% of larvae test.

Keywords: Effectiveness, temephos, Aedes aegypti.

INTRODUCTION

Aedes Aegypti mosquito is the main factor of dengue virus. Not all mosquitoes can spread the dengue virus, only infected female mosquitoes can spread it [1]. Mosquito stops are one of the stages in a mosquito's life cycle. The existence of mosquito larvae is closely related to the incidence of dengue hemorrhagic fever (DHF) [2]. DHF is a disease in the tropics and subtropics caused by dengue virus (DEN-1, 2, 3, and 4) through the bite of Aedes aegypti mosquitoes [3].

Incidence rate (DHF) in Indonesia in 2012 to 2016 experienced fluctuations, including 2012 with IR 37.27 per 100,000 population (90,245 cases), in 2013 IR 45.85% (112,511 cases), in 2014 IR 39.80% (100,347 cases), in 2015 IR 50.75% (129,650 cases), and in 2016 IR 78.85% (204,171 cases). The mortality rate (CFR/Case Fatality Rate) of DHF in Indonesia in 2012 was 0.90% (816 people), in 2013 CFR was 0.77% (871 people), in 2014 CFR was 0.9% (907 people), in 2015 CFR 0.83% (1071 inhabitants), in 2016 CFR 0.78% (1598 inhabitants Ministry of Health of the Republic of Indonesia, 2016, in accordance with the 2014-2019 National Medium-Term Program Plan (RPJMN) for the National IRD DHF target of <20 per 100,000 population and National CFR target <1%, while Indonesia is still far from the national target [4].

A study in DKI Jakarta in 2016 suggested that several reasons for the use of insecticides were influenced by the ease of obtaining the market, the variety of types, and the ease of use. In addition, the convenience of use is also thought to be the reason why people choose certain types of insecticides in addition to being cheap and easy to apply [5].

The occurrence of Aedes Aegypti mosquito resistance to organophosphate insecticides is most

likely due to the use of temephos for a long period of time and is not regular and the dose of insecticide is not fixed [6]. The longer the use of organophosphate insecticides, the Aedes aegypti mosquitoes will be able to adapt to these insecticides [7]. Mosquitoes that have been resistant can reduce their offspring resulting in more widespread organophosphate resistance [8].

One of the prevention of DHF can be done by eradicating the main vector of DHF namely Ae mosquitoes. aegypti which can be done by various methods including mechanically, chemically, and biologically to adult and pre-adult mosquitoes [9, 10]. Among the various types of methods, the use of chemical methods is still widely chosen by the community because of the ease and fast reaction factor in reducing the level of vector density. Among them the use of Malathion and Larvasida temephos insecticides which are still used today [5]. However, the use that is carried out continuously will be able to cause resistance to dengue vector mosquitoes against these chemicals [11].

METHODS

Research Design

This type of research is quasi-experimental (Quasi Experiment) with the Bioassay Test method or testing with field applications. This research was conducted in the Airport Buffer and Poso Sea Port Buffer areas, Poso Regency, Central Sulawesi.

Population and Sample

The population in this study is the Aedes aegypti mosquito larvae in two areas of the Airport Buffer and the Poso Sea Port Buffer in Poso Regency, Central Sulawesi. The samples used in this study were 240 late larvae of Aedes Aegypti instar III or initial IV instar which were bred as a test of Larvaside Temephos resistance of 1% or 0.1 mg / L.

Data Collection

Data collection was carried out by placing ovitraps in several different locations, namely the Airport Buffer and Poso Sea Port Buffer areas, approximately 20 ovitraps at each location. Each building is placed 1 ovitrap inside, especially in every building in the two locations. The ovitrap is placed in a shady and humid place and is ensured to be protected from rain and other mechanical disturbances. Every 1 week the ovitrap is examined to see whether there is an egg attached to each filter paper. If there are eggs attached, filter paper is taken and replaced with new ones. Mosquito eggs still attached to filter paper are transferred into plastic trays that have been filled with water for 1-2 days until they drip into larval stages. During the development process, larvae are fed with bananas

Data Analysis

Analysis of the data used in this research is to describe the characteristics of each study variable, where the frequency distribution and mortality percentage of the mosquitoes tested for the insecticide and larvaside temephos in the buffer zone of Poso Sea Port will be obtained. Furthermore, mortality differences in the Airport Buffer and Poso Sea Port Buffer will be analyzed based on the time taken during testing of different sample combinations, namely within 15 minutes, 30 minutes, 45 minutes, 60 minutes, and 1440 minutes. For the value of Letah Time (LT) larvicide temephos using probability analysis. After that, the data is then presented in the form of distribution tables, frequencies, and graphs that are narrated to discuss the results of the study.

RESULTS

Total Mortality of Temephos Insecticide 1% Exposure to *Aedes Aegypti Mosquito* Exposure.

Table-1: Total Mortality of Aedes Aegypti Larvae Themephos Exposure 1% According to Contact Duration in the Poso Airport Buffer area

Replication	Type	The number of test mosquitoes	Mosquito mortality test Minute-				
			15	30	45	60	1440
1	Control	20	0	0	0	0	0
	1% dose	20	0	2	5	8	20
2	Control	20	0	0	0	0	0
	1% dose	20	0	1	3	7	20
3	Control	20	0	0	0	0	0
	1% dose	20	0	1	4	7	20
Average	Control	20	0	0	0	0	0
	1% dose	20	0	1.333333	4	7.333333	20

In Table-1 shows the results of resistance testing the average number of mortality of Aedes Aegypti larvae exposure to temephos 1% according to contact time in the Buffer Airport area of Poso Airport at an average temperature of 26.49oC and an average humidity of 64.33% occurred at the 30th minute and continued to increase until the 1440th minute. Vulnerable mortality for the 60th-minute test larvae was 3 to 5 with the highest number of mortality between replications being 1 to 2, while in the control in all replications there was no mortality.

Table-2: Total Mortality of Aedes Aegyoti Larvae exposure to Themephos 1% according to Contact Duration in the Poso Sea Port Buffer Area

Replication	Jenis	The number of test mosquitoes	Mosquito mortality test Minute-				
			15	30	45	60	1440
1	Control	20	0	0	0	0	0
	1% dose	20	0	1	3	6	20
2	Control	20	0	0	0	0	0
	1% dose	20	0	1	2	6	20
3	Control	20	0	0	0	0	0
	1% dose	20	0	0	3	5	20
Average	Control	20	0	0	0	0	0
	1% dose	20	0	0.666667	2.666667	5.666667	20

In table 2. shows the results of resistance testing the average number of mortality of Aedes Aegypti larvae of 1% temephos exposure according to the contact time in the Poso Sea Port Buffer area at an average temperature of 26.45oC and humidity of 64.13% occurred in the 30th minute and continued to increase until 1440 minutes. Vulnerability of lava mortality in the 60th minute was 5 to 6 with a difference in the number of mortality between replications of the highest 2 tails, while in the control in all replications there was no mortality.

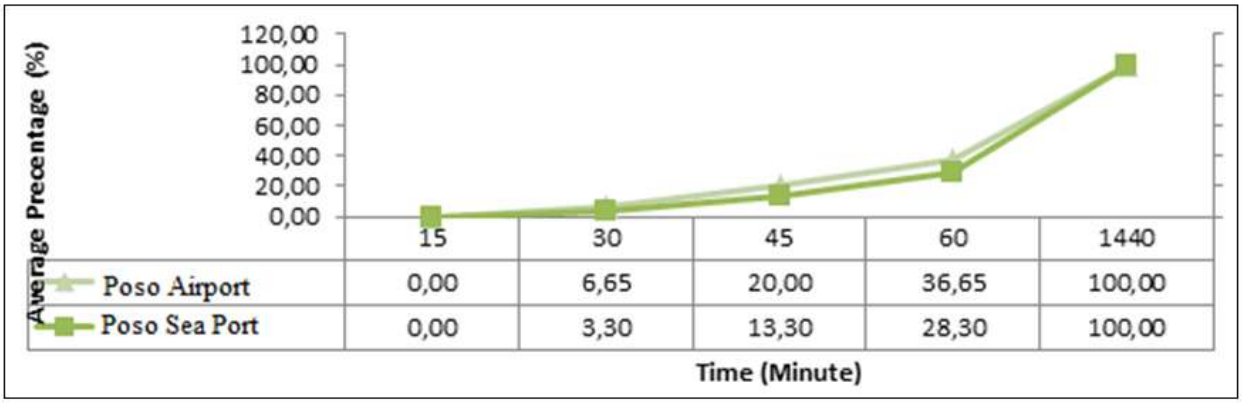

Fig-1: Number of mortality of Aedes Aegypti Larvae exposure to Themephos Insecticide 1% in the Poso Airport Buffer Region and the Poso Sea Port Buffer

In Figure-1 shows the difference in the percentage of mortality of Aedes Aegypti larvae exposure to 1% temephos insecticide in the Airport Buffer area and the Poso Sea Port Buffer during 24-hour observation by looking at mosquito mortality at each interval of 15 minutes, 30 minutes, 45 minutes, and 1440 minutes. The highest average percentage of mortality of Aedes Aegypti larvae at each observation time occurred in the two regions, namely Poso Airport Buffer and Poso Sea Port Buffer at 1440 minute intervals of 100%.

Lethal Time (LT)

Poso Sea Port In Figure-2 the overall lethal time (LT50, LT90, LT95, LT99) values in the Poso Sea Port area are higher than in the airport buffer zone. Where the poso seaport area for larvicide temephos 1% takes longer to kill the Aedes aegypti test larvae, compared to Poso airport. Especially to kill 99% of test larvae in the Poso seaport area, 1% temepos larvaside takes 147.2 minutes or 2 hours 27 minutes while for the Poso airport area it only takes 119.86 minutes or 1 hour 59 minutes to kill 99% of test larvae .

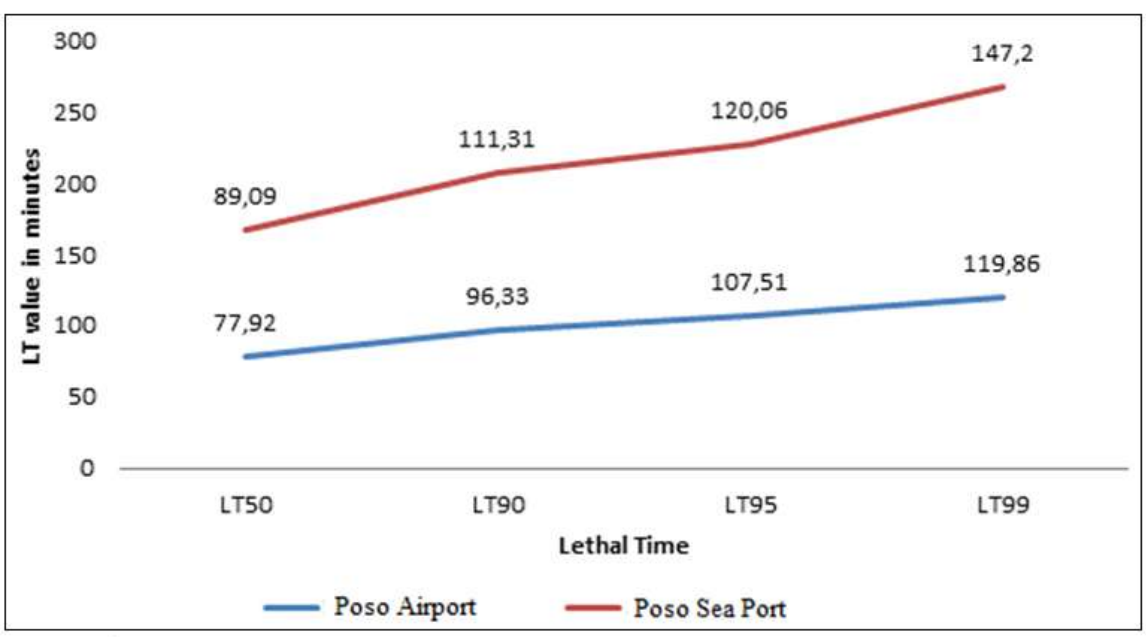

Fig-2: Lethal Time Value (LT50, LT90, LT95, LT99¬) 1% Temephose Insecticide in the Airport Buffer and Poso Sea Port Buffer Areas

Resistance Status

In Table-3., we can find out the status of 1% temepos larvicide resistance in the Poso seaport buffer area for an average number of mortality or mortality of test larvae of 20 or 100% which is in accordance with WHO standard criteria if the mortality of test larvae of 98-100% is said to be vulnerable, 80-97% are said to be tolerant, and less than 80% are said to be resistant so for the status of resistance the poso seaport buffer area is said to be vulnerable due to the death of 100% test larvae. whereas for the Poso airport buffer area for the average number of mortality or mortality of test larvae is also at 20 or 100% which is in accordance with WHO standard criteria if the mortality of the test mosquitoes 98-100% is said to be vulnerable, 80-97% is said to be tolerant, and less than 80% are said to be resistant so that the poso Airport area resistance to 1% is still vulnerable due to 100% test larvae death

Table-3: Status of Resistance of Aedes Aegypti Larvae to Temephos Insecticide 1% in Airport Buffer Areas and Poso Sea Port Buffer

Location	24-Hour Mosquito Mortality Test		WHO Criteria	Status
	n	%		
Poso Sea Port Buffer	20	100	Vulnerable: 98% -100% mortality Tolerant: 80% -97% mortality Resistance: Mortality <80%	Tolerant
Poso Airport Buffer	20	100		Susceptible

DISCUSSION

The status of Aedes aegytpi larvae and mosquitoes resistance to insecticide exposure is determined based on WHO criteria, namely susceptible, tolerant, and resistant observed 24 hours a day. in the Poso Sea Airport and Pelbuhan area.

Difference in mortality of Aedes Aegypti larvae exposure to insecticide temephos 1% in the Poso seaport and Poso Airport in Central Sulawesi. The mortality of Aedes aegypti larvae in this study is a condition in which there are no signs of life with immovable characteristics. The mortality of Aedes aegypti larvae due to larvae contact with temephos insecticide dose of 1%.

The results of this study indicate that the Poso seaport and Poso Airport areas are still vulnerable to exposure to 1% temephos in 24-hour observations. Thus the application of temephos 1% in effective abtization is done at Poso Sea Port and Poso Airport, Central Sulawesi.

This study is in line with research conducted by Salim in Palembang in 2009 found that Aedes aegypti larval stage still tends to range against temephos dose of 0.1 gil (1%). A study by Sinaga, L, S, in Bekasi City in West Java Province in 2016 found that Lartva Aedes aegypti from Jatiasih sub-district, Jatiasih Sub-District, Bekasi City was still vulnerable to temephos. In Buah Batu sub-district, Bandung, it was also found that Aedes aegypti larvae were still sensitive (vulnerable) to temephos 1% with an average number of 100% deaths. In the Barbalha and Crato regions of Brazil, Aedes aegypti mosquitoes have been found to be highly resistant to temephos [12].

Lethal time temephos in this study showed that there was a difference in the lethal time exposure of 1% temephos insecticide exposure in the Poso Airport area and Poso Sea Port. In the Poso Airport area lethal time values (LT50, LT90, LT99, and LT99) exposure to temephos insecticide 1% in a row, namely: 77.92 minutes, 96.33 minutes, 107.51 minutes, and 119.86 minutes, an increase in the value of LT in the Poso Sea Port area, namely: 89.09 minutes, 111.31 minutes, 120.06 minutes, and 147.20 minutes. The LT99 value in the Poso Airport area is 119.86 minutes (2 hours) and in the Poso Sea Harbor area is 147.20 minutes (2.45 hours), if it is associated with the development process of Aedes aegypt larvae will die before developing into an adult mosquito. The results of this test indicate that the 1% concentration/dose of temephos is still very effective in the Poso Airport and Poso Sea Port area, Central Sulawesi.

The factors that influence differences in larval lethal time mortality in the Poso Airport Buffer and Poso Sea Port Buffer areas are the use of insecticide temephos in the Poso Airport Buffer for a long time so that this can cause resistance pressure. Resistance pressure produces genetic changes, namely a mutation of the enzyme protein and a mutation from the non-coding region that functions to regulate the formation of enzymes so that there is overproduction which can cause the metabolism of insecticides. Three groups of enzymes, namely cytochrome p450 monooxygenase, glutathione S transferase (GSTs), and carboxy/cholinesterase (CCEs) associated with insecticide metabolism. This enzyme is also related to mosquito responses to heavy metals, organic pollutants, and chemical insecticides [13].

CONCLUSION

Based on the results of this study, it can be concluded that the Temephos Larvasida 1% Insecticide is still effectively used in the two regions, namely the Airport Buffer and Poso Sea Port area, which is in accordance with the results of the research conducted that Larvasida Temephos 1% can kill 100% of Larva/larvae deaths. test within 1440 minutes or 24 hours in the two regions, where the WHO standard criteria states for the death of larvae of the test 98-100% Vulnerable means larvae can still be eradicated with recommended doses, 80-98% mortality Tolerant, meaning Larvasides is still can be used but there must be an increase in dosage, and <80% Resistant means that Larvasida is no longer usable and must be replaced with another class of Larvasides.

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