Original Article

STATUS OF AEDES AEGYPTI MOSQUITO RESISTANCE TESTS TO INSECTICIDES IN MAROS DISTRICT

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Abstract

Maros Regency is an endemic area for dengue fever. Vector control was used by Malathion and cypermethrin. Continuous use of insecticides can cause resistance. This study aims to determine the resistance status of Aedes aegypti mosquitoes to the insecticides Malathion and cypermethrin. This type of research is experimental research with a descriptive approach. The sample of this study was 400 female Aedes aegypti mosquitoes with four treatments, 25 in one treatment. The Aedes aegypti mosquito test results against malathion insecticide were 0.8% after 60 minutes of exposure; the average mortality rate is 53%. After 24 hours, about 93% and the test results using 0.05% Cypermethrin insecticide resulted in 100% death within 20 minutes. In conclusion, Malathion insecticide in Maros Regency is included in the medium resistant category, and 0.05% Cypermethrin insecticide is included in the vulnerable category according to Permenkes No.50 of 2017, so it is recommended to continue using insecticides made from cypermethrin and the Jumantik group.

Keywords: Resistance, Malathion, Cypermethrin.

INTRODUCTION

Dengue Hemorrhagic Fever in Indonesia is still a public health problem and is an endemic disease in almost all provinces. In the last five years, the number of cases and infected areas has spread widely, often causing Extraordinary Events/KLB. The Indonesian Ministry of Health recorded 110,921 dengue hemorrhagic fever (DHF) cases in Indonesia from January to October 31 2019. (Makassar.antaranews.com/national/berita/1147152/kemenkes-catat-110921-case-dbd-to-October-2019), then in July 2020, the number of cases reached 71,633 cases (https://www.kemkes.go.id/article/view/20070900004/hingga-juli-kasus-dbd-di-indonesia-capai-71-ribu.html)

The South Sulawesi Health Office recorded dengue cases in 2018, the number of cases was 2,141, and the number of deaths was 19. In January 2019, in 683 suspected cases, 323 and 10 people died. In 2020 dengue fever reached 2,166 people, and 19 people were killed until May (https://republika.co.id/berita/qchpxh377/dinkes-sulsel-penderita-dbd-capai-2166-jiwa)

There were 628 cases of dengue fever in the Maros district in 2016. In 2017, there were 253 cases, and in 2018 there were 319 cases while in 2019, there were 97 cases of dengue fever in the Maros district, and two people died (data from the Health Office). Maros, 2019). Maros Regency is an endemic area for DHF. In the last two years, control efforts have been using the insecticide Cynoff 50EC which contains the active ingredient cypermethrin.

Using one type of insecticide continuously for a long time can cause resistance or immunity to the target mosquito. The Aedes aegypti mosquito and other dengue vectors can develop an immune system to frequently used insecticides and resist one insecticide due to exposure to other insecticides. (Rahman et al., 2014). It is supported by the results of research by Isak Tisane (2015) and Muhammad (2016)) class II ports of Abon and Bantul Regency using 0.8% malathion insecticides have been resistant, and the results of research by Indri. et al. (2016) that

0.05% cypermethrin insecticide in the Pasar Tua Bitung area is still tolerant. With the emergence of insect-resistant traits, program implementers need to pay attention to their impact on humans and the environment.

RESEARCH METHODS

This research was conducted in Maros Regency to see the resistance status of Aedes aegypti mosquitoes to malathion and cypermethrin insecticides using an experimental method with a descriptive approach. This research was carried out by rearranging mosquito eggs and testing with a sample of 25 tails. The test used Impregnated Paper Malathion 0.8% and Cypermethrin 0.05%. Contacted for 60 minutes, and the ones still alive are waited for up to 24 hours. This research is guided by the Minister of Health Regulation No. 50 of 2017. When mosquitoes die, 99-100% are Vulnerable, 80-98% are Tolerant, and deaths less than 80% are Resistant.

RESULTS

Table 1. Status of Aedes aegypti Mosquito Resistance to Exposure Insecticide Malathion 0.8%

Test	**Treatment**					**Control**				
	Observation 60 minutes			**24-hour observation**		**Observation 60 minutes**			**24-hour observation**	
	Number of test mosquitoes	Number of dead mosquitoes	% Dead	Number of dead	% Dead	Number of test mosquitoes	Number of dead mosquitoes	% Dead	Number of dead	% Dead
I	25	13	52	23	92	25	0	0	0	0
II	25	13	52	23	92	25	0	0	0	0
III	25	14	56	23	92	25	0	0	0	0
IV	25	13	52	24	96	25	0	0	0	0
	Average		53	10	93	0	0	0	0	0
Temperature	30°C			30°C		30°C			30°C	
Humidity	65%			65%		65%			6%	

Table 1. The test results in table 1 are the results of the Aedes aegypti mosquito test for 24 hours of exposure to 0.8% malathion with a temperature of 30°C and a humidity of 65%. In the first repetition, 52% of Aedes aegypti mosquitoes died; after 24 hours, 92% of mosquitoes died, and two were still alive. Then on the second repetition, the same as the first treatment in the third repetition, 56% of the mosquitoes died. After 24 hours, it was observed that two were still alive. 1 tail, then the 4th repetition on 24-hour observation, one was still alive. n average, two mosquitos were still alive, meaning the resistance level to 0.8% malathion insecticide was 93%, and all controls were live.

Table 2. Status Resistensi Nyamuk Aedes aegypti terhadap Pemaparan Insektisida Cypermethrin 0.05%

Test	**Perlakuan**					**Kontrol**				
	Pengamatan 60 menit			**Pengamatan 24 jam**		**Pengamatan 60 menit**			**Pengamatan 24 jam**	
	Number of test mosquitoes	Number of dead mosquitoes	% Dead	Number of dead	% Dead	Number of test mosquitoes	Number of dead mosquitoes	% Dead	Number of dead	% Dead
I	25	25	100	25	100	25	0	0	0	0
II	25	25	100	25	100	25	0	0	0	0
III	25	25	100	25	100	25	0	0	0	0
IV	25	25	100	25	100	25	0	0	0	0
	Average	25	100	25	100	0	0	0	0	0
Temperature	30°C			30°C		30°C			30°C	
Kelembaban	65%			65%		65%			65%	

Table 2. Test results of Aedes Aegypti mosquitoes against 0.05% cypermethrin with an average temperature of 30ºC and 65% humidity in the first replication, the mosquitoes died 100% as well as in the 4th repetition the mosquitoes died 100% in the 20th minute, while all live controls.

DISCUSSION

A resistance test is a test to detect the presence of vector resistance to the insecticide used. Efforts to control environmental risks are one of the efforts to prevent the spread of ing diseases with potential outbreaks by breaking the vector breeding chain, especially in the Maros Regency. The study results in the Turekale sub-district, Maros Regency, the Aedes aegypti mosquito in the Malathion 0.8% insecticide test, the susceptibility only reached 93% including the moderate resistance category, while the test using 0.05% cypermethrin reached 100%, so it was in the vulnerable category.

In this study, measurements of environmental conditions, including room temperature and humidity, were carried out when mosquitoes were first exposed to the insecticide malathion 0.8% and cypermethrin 0.05%. At the end of the observation on the holding tube for 24 hours, the temperature was 30°C, and the humidity was 65%. It is intended to determine the striking changes in environmental variables. As in rearing, temperature regulation is significant. According to research by Nurulhuda et al. (2016), the optimum temperature for developing Aedes Aegpyti eggs (hatching eggs) is 25ºC. High temperatures are associated with low humidity, so eggs are difficult to hatch and the next phase of larvae or larvae into mosquitoes.

The WHO standard shows that the temperature for resistance testing media ranges from 20˚C-30˚C, and the optimum humidity for resistance testing ranges from 70% - 90%. Room temperature and humidity did not affect the mortality of Aedes aegypti mosquitoes who were contacted for 1 hour with Malathion in the susceptibility test tube and held for 24 hours.

No corrective mortality was calculated using the Abbot formula to control mosquitoes that died. If the control mortality rate was below 10%, it could be ignored, and no correction was needed. If the control mortality rate is greater than 10%, the observed mortality should be corrected using the Abbots formula. (Permenkes No.50,2017)

The research results used the insecticide Malathion 0.8%, 93%, including suspected resistance (directorate PTP2VZ.2018). Malathion is used continuously and has high toxicity compared to other insecticides as fogging material to prevent dengue fever outbreaks. The resistance that may occur is caused because the insect population can adapt to the previously described insecticide so that the insect or mosquito does not die but forms a new resistant population (Dwi., 2015). Malathion 0.8% is one of the insecticides from the organophosphate group, which is very toxic to targets such as the Aedes aegypti mosquito and does not harm humans and animals. (Rosdiana, 2009). Malathion as an insecticide for fogging has been used in controlling dengue vectors by the ministry since 1972. This insecticide is used because it can quickly paralyse insects such as mosquitoes, smells, is corrosive, and works as a stomach poison. Prolonged use can lead to resistance. The benefit is wide and long enough, according to WHO, 1995; Georghiou & Mellon, 1983, and can also cause a decrease in susceptibility to mosquitoes. The research results by Isak Tasane (2015) are that the Aedes aegypti mosquito exposed to the insecticide malathion 0.8%, the mosquito mortality was less than 80% according to WHO standards insecticide was resistant.

The susceptibility of the Aedes aegypti mosquito is also related to its bionomic nature, which likes to lay eggs in small hidden places and hide in hanging clothes. Small areas are filled with water, are temporary, and are often not monitored.

Continuous use of pesticides, no rotation, and application errors can cause resistance to mosquitoes that cause dengue vectors. According to Jhoni et al., 2016. According to WHO, resistance occurs when the vector cannot be killed by an adequate dose of insects and avoids contact with humans.

The observation results of Aedes aegypti mosquitoes that were contacted with the insecticide Cypermethrin 0.05% at 20 minutes, all of the mosquitoes died, so this insecticide was included as insect knockdown. This insecticide belongs to the vulnerable category, so it is still suitable for use. It is in line with the research by Sukmawati. et al. in 2018, which stated that the resistance status of the Aedes aegypti mosquito in Makassar City and Barru Regency for cypermethrin (cyf 50 EC) was still vulnerable.

Insecticide resistance testing is very much needed so that the program, in this case, the health department, can determine which insecticides are still susceptible to insects. Ignorance of insecticide resistance causes programs that use fogging or thermal fog to have a detrimental impact. In addition to being wasteful in using insecticides in vain, this will also increase the susceptibility of mosquitoes or target insects and impact the environment because they contain toxins. The insecticide residue used will enter the atmosphere and reach the food chain until it returns to humans (Sukmawati., 2018)

According to Arif Sumantri 2017, the use of appropriate insecticides is one of the essential factors in determining the success of vector control, such as the dengue fever vector, namely the Aedes aegypti mosquito. The thing that needs to be considered in the use of pesticides is the accuracy in determining and measuring doses. Doses that are too high will cause waste of insecticides and damage the environment. Doses that are too low cause the vector to not die and accelerate the emergence of resistance.

Resistance can also occur from an insect population already resistant to insecticides. The nature of resistance is hereditary. Until then, resistance occurs in the entire population. Resistance occurs due to gene changes that cause mutations, and the mutants become resistant. Or people that are susceptible to adapting to the effects of pesticides so that they do not die and form new populations that are resistant.

One way to control dengue vectors is by using insecticides due to their practical, economical use and easy-to-see results. The effect of insecticides on the mortality of Aedes aegypti mosquitoes is determined by the mortality rate 24 hours after spraying according to standard testing. The mechanism of insect resistance to insecticides consists of three (3) ways: increasing detoxification to become non-toxic, insects becoming immune caused by specific enzymes, then due to decreased target or insect sensitivity and reduced penetration rate of insecticides through the skin. (Sutarto. et al. in 2018)

After seeing the results of the resistance test of the Aedes aegypti mosquito to the malathion insecticide, the results were resistant, so it was no longer used, while at this time, Kab. Maros still uses Cynoff 50 EC. In this case, cypermethrin is still susceptible, so it is still suitable for vector control of dengue fever, but why is the issue still high? The community's behaviour is possible so that Aedes Aegpyti mosquitoes are still breeding. Control using insecticides is not the spearhead in controlling

the Aedes aegypti population so that the community and programs can reduce it. Through mosquito nest eradication activities (PSM), namely 3 M (draining, closing and stockpiling) or by monitoring Aedes aegypti larvae independently, known as larvae monitoring Jumantik, one house one Jumantik. It can be in the form of an independent Jumantik that monitors at home. Especially during this pandemic, dengue is even more dangerous.

CONCLUSION

Based on the results of the research that has been done, the following conclusions can be drawn:

1. Malathion insecticide 0.8% in Maros Regency is included in the tolerant category based on the Permenkes standard No. 50 of 2017

2. Insecticide Cypermethrin 0.05% in Maros Regency is categorised as vulnerable based on Permenkes standard No. 50 of 2017.

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