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Susceptibility Test of *Aedes aegypti* Larvae to Temefos (Abate)

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ABSTRACT

Dengue fever is an infectious disease transmitted by the *Aedes aegypti* mosquito. Temefos is a tool used in controlling *Aedes aegypti* larvae and its use for a long time without based on rules can cause resistance. This study aims to determine the susceptibility status of *Aedes aegypti* larvae to Temefos in the Ciamis and Cimaragas areas. The method of this research is experimental with samples obtained from residential areas in Ciamis and Cimaragas sub-districts then hatched into instar IV larvae at the Parasitology Laboratory of STIKes Muhamamadiyah Ciamis in May 2019. The results of the test on temefos 0.1 g showed that *Aedes aegypti* larvae from both regions obtained the results of Ciamis (100%) and Cimaragas (100%) sub-districts were still susceptible to temefos. From these results it can be concluded that the test larvae from both areas are still susceptible to temefos so that the tool can still be used as a larvicide, especially in controlling *Aedes aegypti* mosquitoes.

Keywords : *Aedes aegypti*, Temefos, Larva *Aedes aegypti*.

INTRODUCTION

Dengue hemorrhagic fever (DHF) is an infectious disease that is a health problem especially in tropical developing countries. According to the WHO, before 1970 only 9 countries experienced dengue outbreaks, but in the early 21st century there are more than 100 countries in Africa, the Americas, Southeast Asia and the Western Pacific (Ducheyne et al., 2018).

In Indonesia, the number of dengue cases increased from 58 cases in 1968 to 126,675 cases in 2015. The increase and spread of cases can be caused by high population mobility, urban development, changes in population density and distribution (Saleh et al., 2018). In Ciamis District in 2010 there were 247 cases, in 2011 there were 98 cases, in 2012 there were 138 cases, in 2013 there were 242 cases and until July 2014 there were 153 cases with 1 death (Hendri et al., 2015). In 2013, Ciamis sub-district was ranked the first dengue-prone area out of 9 sub-districts in Ciamis district. In 2014, the number of DHF cases increased to 94. However, in 2015 cases decreased to 55 cases. In contrast, Cimaragas sub-district had only 8 cases of DHF from 2013-2015 (Dinkes, 2015).

Dengue is transmitted by the *Aedes aegypti* mosquito. The dengue virus is transferred from one person to another with the mosquito's saliva when the mosquito sucks blood (Firmanta, 2008). The *Aedes aegypti* mosquito has a small body size, has a black base color with white spots especially on its legs. Its typical morphology is having a white lyra-form on its back (mesonotum) (Hidayati, 2018).

Vector control efforts are one way to break the chain of transmission, one of which is by killing mosquitoes at the larval stage with larvicides because they are considered effective and conducting fogging (Sutanto, 2008). In Ciamis settlement, the frequency of fogging is more frequent because the cases of DHF sufferers are higher than in Cimaragas settlement.

Currently, the most widely used larvicide to control *Aedes aegypti* larvae is temefos. In Indonesia, temefos 1% (abate) has been used since 1976 (Damayanti

et al., n.d.). Mosquito resistance to insecticides is one of the obstacles in controlling dengue fever. The occurrence of resistance is due to prolonged use and use without the rules of use (Kurniawan, 2019).

Abate or temefos is an insecticide belonging to the organophosphorus group. It is usually sold as sand granules. This insecticide is highly toxic to mosquito larvae but not toxic to humans, even in drinking water. Temefos is the most effective insecticide against *Aedes aegypti* larvae, especially those that are resistant to chlorinated hydrocarbons (Safar, 2009).

According to the results of the research that has been conducted oleh Zuhriyah et al. (2016) The use of temefos as a larvicide is still relevant for the control of *Aedes aegypti* larvae in Baros, Sriwedari and Nanggeleng urban villages in Sukabumi city. For the successful control of dengue fever, community participation is needed in conducting abatement routines and cleaning places that become nests for *Aedes aegypti* mosquitoes. In general, the use of insecticides is very successful in controlling some types of insects, but the continuous use of insecticides will cause resistance and various environmental problems. For this reason, it is necessary to know the susceptibility status of *Aedes aegypti* mosquito larvae from Ciamis, Cimaragas and Litbang areas to temefos insecticide by means of susceptibility status testing.

METHODS

This study is an experimental design consisting of two groups, namely the control group and the treatment group. The study was conducted in May 2019 at the STIKes Muhammadiyah Ciamis Laboratory with a population of 300 samples of *Aedes aegypti* instar IV mosquito larvae obtained by catching eggs from the Cimaragas area, Ciamis and from Pangandaran which is The **National Institute of Health Research and Development** (Indonesian: *Loka Penelitian dan Pengembangan Kesehatan*, abbreviated as Lokalitbangkes) with each experiment in the Ciamis residential area 25 larvae, Cimaragas 25 larvae and from

Lokalitbangkes 25 larvae for control. Each treatment was repeated three times except for the control.

The instruments used were ovitrap, measuring cup, stirring rod, beaker, plastic pipette and tray. The research procedure starts from (1) Catching eggs with ovitrap (Ovitrap Installation); (2) Ovitrap Placement; (3) Hatching eggs into larvae; (4) Maintenance of *Aedes aegypti* larvae; (5) Identification of larvae and; (6) Susceptibility test. The data obtained were presented descriptively.

RESULTS

The results of the study on the susceptibility test of *Aedes Aegypti* larvae to temefos (abate) are as follows:

Table 4.1 Susceptibility test results of *Aedes aegypti* larvae to Temefos

Susceptibility Test of *Aedes aegypti* Larvae to Temefos					**Percentage of Larvae That Die (%)**	**Susceptibility Status**
Larval Origin	**Total Larval Mortality (Tails)**					
	First Repetition	**Second Repetition**	**Third Repetition**	**Control**		
Ciamis Settlement	25	25	25	0	100	Susceptible
Cimaragas Settlement	25	25	25	0	100	Susceptible
Litbang Pangandaran	25	25	25	0	100	Susceptible

Description Vulnerability (%):
<80 % : Resistant
80-97% : Resistant
98-100% : Susceptible

Table 4.1 shows that all three test larvae died within 24 hours from Ciamis, Cimaragas and Litbang Pangandaran. Ciamis, Cimaragas and Litbang Pangandaran are categorized as vulnerable because the percentage of dead larvae is 100%.

DISCUSSION

In the susceptibility test after 24 hours, it was found that all test larvae died

both from Ciamis, Cimaragas and Litbang Pangandaran. Based on the WHO susceptibility category, the results of the susceptibility test of *Aedes aegypti* larvae in the Ciamis, Cimaragas and Pangandaran R&D areas are included in the susceptible category, namely the number of deaths >98%, so temefos is still effective for killing *Aedes aegypti* larvae. In testing the susceptibility status, IV instar larvae are used, because the size is large enough to facilitate observation (Putra et al., 2017).

Temefos with the trademark abate is one of the larvicides of the organic phosphate compound group that can enter and be eaten by mouth. This class of insecticides has a mode of action that inhibits the cholinesterase enzyme in both vertebrates and invertebrates, causing interference with nerve activity due to the accumulation of acetylcholine into choline and vinegar acid so that if the enzyme is inhibited, acetylcholine hydrolysis does not occur. This acetylcholine functions as a mediator between the nerves and the meat muscle, allowing the transmission of electrical impulses that stimulate the meat muscle to contract for a long time so that convulsions occur. Temefos will bind to the cholinesterase enzyme and destroy it resulting in continuous muscle contractions, convulsions and eventually the larvae will die (Ridha & Nisa, 2011).

Abatement can lead to resistance if not properly monitored. The number of resistant larvae or mosquitoes increases over time, resulting in the development of mosquito or larval immunity to the insecticide used. Larval resistance to abate can lead to the failure of abatement in dengue control programs (Fenisenda, 2016). In the Ciamis and Cimaragas areas, the tested *Aedes aegypti* larvae are not yet resistant, possibly because the community uses several methods in controlling DHF, not only using temefos, but interspersed with biological controls such as using fish eaters (Widawati et al., 2015).

In Indonesia, many studies have been conducted on the susceptibility status of *Aedes aegypti* larvae to temefos. Research conducted by Fenisenda (2016) In the Perimeter and Buffer areas of Tanjung Emas Port, Semarang City shows that

the Tanjung Emas Port Perimeter area is included in the tolerant category (mortality <98%), while the Tanjung Emas Port Buffer area shows a mortality rate of 68% so that it is categorized as resistant. Research by (Ipa et al., 2017) in Banda Aceh City and Lhockseumawe larvae to temefos showed that they were still susceptible but in Aceh Besar District they were tolerant. Research by Putri (2018) in Lubuk Basung urban village, Garagahan urban village, Manggopoh urban village, Kampung Tangah and Kampung Pinang in Agam district are categorized as vulnerable, with >98% mortality.

CONCLUSION

In the results of the susceptibility test of *Aedes aegypti* larvae to temefos (abate) in the Ciamis and Cimaragas areas, it can be concluded that the test larvae from both areas are still susceptible to temefos so that they can still be used as larvicides, especially in controlling *Aedes aegypti* mosquitoes. Future research is expected to test the susceptibility of *Aedes aegypti* larvae to temefos (abate) in other areas.

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