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Mapping of A. Aegypti L. Resistance Zone Against Malathion in Yogyakarta

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ABSTRACT

Background: Fogging is one way of controlling dengue hemorrhagic fever that has been done by the government. Malathion is one of the active ingredients used to kill *A. aegypti*. However, the long-term use of malathion can lead to resistance. The city of Yogyakarta has been using malathion in fumigation for more than ten years. During the last ten years, dengue cases still occur in the city of Yogyakarta; this allows resistance against *A.aegypti* against malathion. The purpose of this research is to describe the resistance zone in Yogyakarta City. **Methodology:** The method used is by laboratory test with bioassay. The degree of resistance is known from the reading of absorbance values using the Eliza reader with a wavelength of 450 nm. Higher absorbance values indicate higher non-specific esterase enzyme activity. The nature of resistance is shown by the high activity of non-specific esterase enzymes. **Results:** The results of this study indicate that 73.3% are vulnerable and 26.67% resistant to the 17 sub-districts examined. The vulnerable areas are still larger than those resistant because in the use of malathion has been replaced with sipermetrin. However, the presence of resistant species should be noted because resistant species can produce long-lasting offspring. **Conclusion :** *A. aegypti* mosquito resistance status toward malathion in Yogyakarta City was 73.3% more susceptible and 26.67% resistant.

KEY WORDS: Map, Resistance, Vulnerable

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INTRODUCTION

Dengue Haemorrhagic Fever (DHF) for nearly two centuries is classified as fever, colds or diarrhea.[1] The case of DHF first appeared in Surabaya and Jakarta in 1968, the number of cases continues to increase gradually over a short period DHF incidence spread throughout the region of the

Republic of Indonesia.

Indonesia includes areas that are endemic to the spread of dengue fever so that anytime can infect and attack the population of Indonesia.[2] The high prevalence of DHF can not be separated from the high-risk factors of transmission in the community such as the free rate of larvae (ABJ) which is still below 95%, ie, 87.88% of new houses in 2010 free from larvae *A. Aegypti*.[3] Many biochemical assays and hematological investigations may aid in the further diagnosis and treatment of the fatal disease.[4] Meanwhile, DHF control is mostly focused on reducing mosquito density. The use of chemical insecticides is still the relevant control tool used by the government against dengue vector.[5] It is because of the absence of proper vaccines and therapeutic drugs.[6]

DHF control programs have been widely rolled out by the government, some of which is the implementation of fogging or fumigation using malathion. Fogging by removing the smoke was aimed at killing mosquitoes *A. aegypti*. adult. The long fogging program since 1969 and larvasidation program of temefos since 1980 by this government turned out to give a negative impact. One of them is the happening of mosquito resistance. This resistant nature will make mosquitoes more difficult to control so that DHF transmission is also increasingly difficult to control.[7]

Geographic Information Systems (GIS) is a collection of tools that serve to collect, store, search, edit and visualize spatial data from the real world for a particular interest. In public health, GIS can combine multiple data sources to identify, including environmental elements.[8]

GIS can help in understanding the existence of disease distribution and other health problems to understand the picture of human relations and the surrounding environment.[9]

Special Region of Yogyakarta consists of 4 regencies and one municipality with 393 villages, 45 urban villages and 14 sub-districts.[10] Based on the background of the use of organophosphates in the control of dengue fever can cause resistance to *A. aegypti* mosquitoes then the researchers are interested to do the mapping of *A. aegypti* mosquito resistance zone against organofosfat malathion in DIY.

MATERIALS AND METHODS

This research model is descriptive research with a laboratory test. A laboratory test used is bioassay test with the readability of use with Eliza reader. The more concentrated it absorbs higher and indicates the activity of high specific non-specific esterase enzymes. Conditions that indicate levels of nonspecific esterase enzyme activity show that mosquitoes are increasingly resistant to malathion.

RESULTS

Umbulharjo sub-district

Based on AV readings obtained a negative control average value of 0.246 with a standard deviation of 0.079 this value is used as a cut off point reading is the average AV negative control + 3SD of 0.484. It is said to be vulnerable if AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD. The result is vulnerable 89.33% and resistant 10.67%.

Pakualaman sub-district

Based on AV readings obtained a negative control average value of 0.357 with a standard deviation of 0.066 this value is used as a cut off point reading is the average AV negative control + 3SD of 0.556. It is said to be vulnerable if AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD The result is vulnerable 97.33% and resistant 2.67%.

Danurejan sub-district

Based on AV readings obtained a negative control average value of 0.256 with a standard deviation of 0.048 this value is used as a cut off point reading is the average AV negative control + 3SD of 0.400. It is said to be vulnerable if AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD. The result is vulnerable 93.33% and resistant 6.67%.

Mantrijeron sub-district

Based on AV readings obtained a negative control average value of 0.157 with a standard deviation of 0.044 this value is used as a cut off point reading is the average

AV negative control + 3SD of 0.290. It is said to be vulnerable if, AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD. The result is vulnerable 45.33% and resistant 54.56%.

Gedongtengen sub-district

Based on AV readings obtained a negative average value of 0.187 with a standard deviation of 0.034 this value is used as a cut off point reading is the average AV negative control + 3SD of 0.289. It is said to be vulnerable if AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD. the result is vulnerable 88% and resistant 12%.

Mergangsan sub-district

Based on AV readings obtained a negative control average value of 0.167 with a standard deviation of 0.035 this value is used as a cut off point reading is the average AV negative control + 3SD of 0.273. It is said to be vulnerable if AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD, the result is vulnerable 86,67% and resistant 13,33%.

Gondokusuman sub-district

Based on AV readings obtained the average value of negative control 0.172 with a standard deviation of 0.065 this value is used as a cut off point reading is the average AV negative control + 3SD of 0.369. It is said to be vulnerable if AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD, the result is vulnerable 96% and resistant 4%.

Ngampilan sub-district

Based on AV readings obtained a negative control average value of 0.181 with a standard deviation of 0.056 this value is used as a cut off point reading is the average AV negative control + 3SD of 0.349. It is said to be vulnerable if AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD, the result is vulnerable 74,67% and resistant 35,33%.

Kraton sub-district

Based on AV readings obtained a negative control average value of 0.139 with a standard deviation of 0.024 this value is used as a cut off point reading is the average AV negative control + 3SD of 0.211. It is said to be vulnerable if AV <average negative control AV + 3SD and resistant if AV e" average AV negative control + 3SD, the result is vulnerable 64% and resistant 36%.

Gondomanan sub-district

Based on AV readings obtained the average value of negative control 0.259 with 0.096 standard deviation value is used as a cut off point reading is the average AV negative control + 3SD of 0.547. It is said to be susceptible if AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD, the result is vulnerable 90.67% and resistant 9.33%.

Kotagede sub-district

Based on AV readings obtained a negative control average value of 0.136 with a standard deviation of 0.043 this value is used as a cut off point reading is the average AV negative control + 3SD of 0.265. It is said to be vulnerable if AV <average negative control AV + 3SD and resistant if AV e" average AV negative control + 3SD, the result is vulnerable 94,67% and resistant 5,33%.

Tegalrejo sub-district

Based on AV readings obtained the average value of

FIGURE 1:
Map of Resistance Zone A. Aegypti in Yogyakarta City



negative control 0.134 with a standard deviation of 0.023 this value is used as a cut off point reading is the average AV negative control + 3SD of 0.204. It is said to be vulnerable if AV <average AV negative control + 3SD and resistant if AV e" average AV negative control + 3SD, the result is vulnerable 49.33% and resistant 50.67%.

Jetis sub-district

Based on AV readings obtained the average value of negative control 0.114 with standard deviation 0.017 this value is used as a cut-off point reading is the average AV negative control + 3SD of 0.165. It is said to be vulnerable if AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD, the result is vulnerable 78,67% and resistant 21,33%.

Wirobrajan sub-district

Based on AV readings obtained a negative control average value of 0.206 with a standard deviation of 0.059 this value is used as a cutoff point reading is the average AV + 3SD negative control of 0.290. It is said to be vulnerable if AV <average AV control is negative + 3SD and resistant if AV e" average AV negative control + 3SD, the result is vulnerable 36% and 64% resistant.

DISCUSSION

Resistance test results from all sub-districts in Yogyakarta City shows that from 14 sub-districts indicate that 73.3% are more vulnerable and 26.67% are resistant to malathion. This is very reasonable because in the past more than 5 years the fogging process has been using sipermetrin and malathion has been discontinued. Malathion can be used again as an alternative insecticide replacement sipermetrin for fogging as one way of rolling insecticides in reducing the risk of resistance in *A. aegypti* mosquitoes. If mapped based on these results then can be seen as follows

Based on the above map can be seen that most areas in Yogyakarta City are vulnerable, only three areas are still resistant status. In accordance with the above explanation that 73.3% of the vulnerable area is due to the presence of rolling in the use of insecticides. The rolling of the insecticide use causes the turn of the resistant status to become vulnerable because of the change of insecticide, the vector is dead and the newly emerging vector carries only the vulnerable gene so that the vector that develops and spreads in the region is the vector carrying the vulnerable gene. This is what causes the resurgence of resistant status to be vulnerable.

The result of Elyza reader can be known by reading absorbancy value, it shows the activity of non-specific esterase enzyme to indicate the existence of vulnerable and resistant. The more concentrated the color the higher the activity of non-specific esterase enzymes so that the mosquitoes are more resistant to malathion. This color reading is a qualitative method and the nature of this color observation should be done quickly because within a short time the color will change. This qualitative way should be continued with a quantitative way that is with a visual reading is by reading the value of absorbance (AV) with a wavelength of 450 nm. This AV value will be a reference whether the resistance status of *A. aegypti* mosquito larvae is susceptible or resistant.

The result of resistant measurement in every sub-district in 14 sub-districts was found that from 14 sub-districts in Yogyakarta City, 73.3% or around 11 urban villages examined were more vulnerable and 26.67% or about three urban villages examined were resistant to malathion. Based on the discussion with infectious disease control team, the use of malathion has been done for more than ten years and rolling in 2010. Insecticide use for a long time of 2 to 20 years and improper use of dosage can cause resistance.[11] In resistant mosquito populations, the use of insecticides of the same and continuous type and mode of action will not be effective. Substitution of type and manner of work in the use of insecticide should be done within 2-3 years or 4-6 times application.[12]

Repeated use of insecticide for a long time will make the resistant mosquitoes stay alive; this becomes ineffective because the number of resistant mosquitoes is much higher than the susceptible mosquitoes.[13] Over time the proportion of resistant insects in a population will increase and eventually the population is dominated by resistant insects.[14] The surviving mosquitoes show immunity to the mosquito's body against the active chemicals contained in the malathion.[15]

Transmission of dengue virus occurs in many densely populated areas such as urban and rural

suburbs.[16] The adjacent location between these areas can lead to the process of migrating mosquitoes from resistant areas to vulnerable areas. This needs to be watched because the vulnerability that occurs in mosquitoes can be reduced to the next generation.[17] The effectiveness of insecticide use can be maintained by further reducing the resistance to mosquitoes. Otherwise, insecticide resistance can be a potential threat to global public health.[18]

CONCLUSION

A. aegypti mosquito resistance status toward malathion in Yogyakarta City was 73.3% more susceptible and 26.67% resistant

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