

Resistance Status of aedes sp strain from High Land in Central Java, Indonesia, as an indicator of Increasing Vectors Capacity of Dengue Hemorrhagic Fever

by Martini Martini

Submission date: 08-Feb-2019 08:54AM (UTC+0700)

Submission ID: 1074755047

File name: Resistance_Status_of_Aedes_sp.pdf (313.79K)

Word count: 2951

Character count: 16170

ORIGINAL ARTICLE

Year : 2017 | Volume : 10 | Issue : 1 | Page : 71–75

Resistance status of *aedes sp* strain from high land in Central Java, Indonesia, as an indicator of increasing vector's capacity of dengue hemorrhagic fever

Bagoes Widjanarko, Martini Martini, Retno Hestingsih

Faculty of Public Health, Diponegoro University, Prof Sudarto SH Tembalang Street, Pedalangan Semarang City, Indonesia

Correspondence Address:

Dr. Martini Martini
Faculty of Public Health, Diponegoro University, Prof Sudarto SH Pedalangan, Tembalang Semarang City
Indonesia

Abstract

Context: The increased cases of dengue hemorrhagic fever (DHF) have been reported in the highland of Wonosobo District. Vector-control program are used for prevention and control of dengue cases. Vector's profile toward insecticide efficacy is important which need to be elucidated. **Aims:** The aim of this study was to describe the resistance status of the vector against malathion insecticide. **Settings and Design:** A cross-sectional survey was done in the highland area, Wonosobo sub-district, Indonesia. **Methods and Material:** The study included a sample of 37 villages, which were located at Wonosobo sub-district. At every village, we observed 15 houses. The observed variables were mosquito bionomic, and their resistance status was based on the biochemical and molecular parameters. To detect resistance status, we used ELISA equipment. **Statistical analysis used:** Data were collected by entomology students and were analyzed using descriptive statistics. **Results:** The study results showed that the population of *Aedes sp* in the Wonosobo District was higher than the standard control of dengue program. Vector indexes were HI (14.75%), CI (6.8%), BI (15.6%), and OI (11.3%). We identified that vectors have already developed resistant to organophosphate insecticide, as many as 50% out of the total sample tested. **Conclusions:** This finding indicated that *Aedes sp* strain in the Wonosobo District highland has competence to be dengue vectors. Therefore, it is important to use another type of insecticide such as pyrethroid.

How to cite this article:

Widjanarko B, Martini M, Hestingsih R. Resistance status of *aedes sp* strain from high land in Central Java, Indonesia, as an indicator of increasing vector's capacity of dengue hemorrhagic fever. *Ann Trop Med Public Health* 2017;10:71-75

How to cite this URL:

Widjanarko B, Martini M, Hestingsih R. Resistance status of *aedes sp* strain from high land in Central Java, Indonesia, as an indicator of increasing vector's capacity of dengue hemorrhagic fever. *Ann Trop Med Public Health* [serial online] 2017 [cited 2019 Jan 24];10:71-75
Available from: <http://www.atmph.org/text.asp?2017/10/1/71/205543>

Full Text

Introduction

Dengue hemorrhagic fever (DHF) is a communicable disease caused by dengue virus and transmitted from person to person through *Aedes* (Ae) from subgenus *Stegomyia*. There has been constant increase in the incidence and geographical expansion of DHF. According to the World Health Organization (WHO), 50 million new cases occur annually and more than 40% of world population are at risk [1]. Subsequently, in 2008, according to the Indonesian National report, the incidence rate (IR) was 58.94/100.000 with a case fatality rate (CFR) of 0.86% [2]. Although, in comparison to the 2007, there was a decrease in the incidence of DHF this time, it is still high compared with national target of about 20/100.000 per year. As predicted by Intergovernmental Panel on Climate Change (IPCC), there would be a substantial increase in the DHF incidence in Indonesia in the following years.

Central Java Province is one of the DHF endemic areas in Indonesia. According to the Health Agency in Central Java, there were 18,877 DHF cases in 2009. The disease IR was 57.9/100.000, and CFR was 1.42%. In that period, all districts and cities (35 districts/cities) in Central Java province either in highland or lowland reported DHF cases. From 2001 to 2008, Wonosobo District reported the IR less than 10/100.000 people. The following year, the IR of DHF in Wonosobo was 59.7/100.000 people and CFR was 0.43%, whereas in 2010, the IR was 22.3/100.000 people. In 2009, the DHF infection spread in all districts in Central Java Province including plateau areas such as Banjarnegara and Wonosobo. This fact indicates that the assumption that dengue cases of occurred in Wonosobo are imported cases can no longer be maintained. The possibility that the local mosquitoes have been changed and have capacity to be vectors need to be considered. The environmental factors such as abiotic environment (global warming), temperature, rainfall, and humidity, the use of certain pesticide, and human activities may affect vector's bionomic. Michael et al. stated that human activities affected the tropical forest and the higher gas emission in air; hence, the earth temperature increases about 1–3.5°C. The change in the environment component will impact the species on the ecosystem and the transmission pattern of vector and viruses [3].

Dengue prevention activities in Indonesia have been done. An an adequate result happened due to the various causes such as lack of staff capability in applying vector control technology, vector surveillance system and managerial. Factors responsible for the failure of DHF prevention in Indonesia are scarcity of skilled healthcare units, lack of the development in science and technology, and no standards for vector surveillance system, technical practice, and vector control management [4],[5].

The Wonosobo District, located in Central Java Province in Indonesia, is a highland that lies between 270 and 2250 masl. Wonosobo District is mountainous area. The district large is 98.468,11 ha. The land use changed compared to the previous year. There is an increase in the land use by buildings, yards, pools, farms, and so on [6]. According to the Wonosobo Health agency, the geographic expansion of DHF patients distribution reported from the Wonosobo Health agency is large, and all the health services around the district reported the cases (either dengue fever or DHF). In 2009, a total of 179 cases (IR = 29/100.000) were reported by Wonosobo Health Centre which is located in the 757 m masl. Thus, it indicates that increased cases of dengue transmission have occurred in this highland region. In the past, we used to think that topography of Wonosobo and environment parameters such as air and temperature affect the capability of mosquito as the DHF vector [7],[8]. Similar to other cultivation places, the farmers in Wonosobo used pesticides to secure their crops. Massive application of certain insecticide can implicate the increase of vector resistance against that insecticide [9]. The research report in 1985 showed that the vector *Anopheles aconitus* is resistance against DDT and dieldrin in Central Java Province [10]. Marcombe et al. stated some factors causing the resistance, such as agriculture practice, vector control intervention, and the urbanization. Mosquito resistance to the pesticide allows mosquitoes to survive longer and develop its capacity as a vector of dengue [11].

Subject and Methods

This was observational study based on the cross-sectional survey approach. This research prior with the spot survey in the study location to get the *Aedes* mosquito strain Highland of Wonosobo District. Mosquitoes in the highland of Wonosobo District are subject of this study. The mosquitoes were obtained by placing the ovitrap (mosquito egg trap) in the village with the new DHF case. The ovitraps were placed indoor and outdoor of 15 houses. The measured variables in this research are the type of *Aedes sp* found in the highland area of Wonosobo District, the trapped mosquitoes types, the mosquito density, and the resistance status based on the biochemist and biomolecular tests.

In the biochemical test, the mosquitoes were homogenized individually in 100 μ L buffer phosphate (pH 7.4). A 50 μ L aliquot from every homogenate was placed in the microplate and then 50 μ L substrate α -naphthyl acetate was added. In every hole of the microplate, 50 μ L coupling agent was added as a color indicator. The microplate was incubated for 10 minutes in the room temperature. The color intensity produced by every hole was measured for the optical density (OD) value using a micro-assay reader at a wavelength of 450 nm and then a comparison with OD value from negative control is made.

Data were collected by the researcher and the entomologist. To warrant the equal perception in this research, there was a prior coordination between the researcher and the team. The collected data were analyzed descriptively as shown in [Table 1] and [Figure 1].{Table 1}{Figure 1}

Results

Previously, people believed that DHF in Wonosobo district were occurred because import cases or not local transmission. Not all sub-districts reported the DHF case. Wonosobo sub-district reported the highest DHF cases in 2014–2015 with a DHF IR of 26.72/100.000. It was followed by Leksono sub-district with a DHF IR of 25.33/100.000. On the other hand, the other 13 sub-districts had IR below 10/100.000. However, the highest IR in the Wonosobo District is in Wonosobo Barat village, 150.98/100.000 people, followed by Sambek village, 78.17/100.000 people.

The collected larvae density during survey in 38 villages is described in the [Table 1], and the variables used to measure larvae populations were house index (HI), Breteau index (BI), container index (CI), and ovitrap index (OI). The density of mosquitoes is quite high. It was showed that the HI was 14.75%, CI 7%, BI 15.16%, and OI 11.3%. The rearing result from the larvae and ovitrap survey that had been identified showed the presence of *Ae. aegypti* and *Ae. albopictus* [Figure 1]. In the previous survey (in 2014), the presence of *Ae. Annadale* was identified.

Based on the observation of the mosquito breeding place, it can be concluded that bathroom container had the highest larvae concentration (60.5%) from all the positive larvae container types. Bamboo tube, used can, broken glasses/jar, used tire, flower pot/vase, water dispenser, fridge, and water-filled ponds also proved to be mosquito breeding places. The dispenser is a container with almost 5% larvae. In the laboratory, larvae from the field were reared to be adult mosquito. Then, mosquito sent to advanced laboratory of Vector Research Centre to be done biochemical resistance test. We tested 90 adult mosquitos' samples that collected from 13 villages in Wonosobo sub district. It showed that almost of that collected from 13 villages in Wonosobo showed that almost half of the mosquito samples were categorised high resistance against insecticide malathion.

This resistance was tested quantitatively using the Elisa reader or visually by measuring the color change. The resistant character of *Aedes sp* against organophosphate. The escalation of esterase enzyme as the *Aedes*' enzyme defense toward organophosphate is the indicator of *Aedes* resistancy investigations, the mosquitoes residency status is described in [Table 1]. Almost all the tested mosquitoes were collected from Milipak, Leksono, and Gunung Talang (90%). There are very limited mosquitoes found that are susceptible to the organophosphate insecticide, excluding Kalianget village (50%).

Discussion

The increased presence of resistance enzyme indicates the occurrence of the main mechanism on the resistance against organophosphate.[12] All regions in Wonosobo showed that the resistance has occurred in this district. In 2009, the outbreak of DHF was four times higher than the previous year. Since then, the DHF case reports are decreasing, and the number is steady now, with approximately 25–50 DHF cases reported every year. The evidence that the transmission occurred was proved in a previous study. The use of malathion had stopped for the last 3 years. Nowadays, a pyrethroid-type insecticide is used in the control program.

Even though insecticide use had been replaced by pyrethroid in the last 3 years, the mosquito population which is resistance against malathion still exists. The insecticide use for a long period of time to the same target can give the selection pressure of population and push the *Aedes sp* population faster to become resistant.[13],[14] The weak mosquito population decreased allowing the resistant mosquito population to live and breed.

A number of studies reported the occurrence of resistance. Shinta et al.[15] reported the *Ae. aegypti* population in five areas in Jakarta, and Bogor city in Indonesia is resistant against malathion 0.8%. Research in Mampang Prapatan and Tanjung Priok also showed the same result.[12] In Purbalingga, Kendal, Grobogan, and Semarang, there were also resistance cases against malathion.[16] Many provinces in Indonesia have reported the resistance of *Aedes sp*.

Malathion is the insecticide within organophosphate classification. Based on their function, esterases are classified into the hydrolase enzyme group. That enzyme catalyses the reaction of aliphatic hydrolase compound, an aromatic ester, choline ester, and organophosphate. Enzyme could break the insecticide resistant process for the organophosphate group.[17] The resistance mechanism happened because it blocked the insecticide compound to reach its target by enzymatic activities.

The characteristic difference of general resistant in every mosquito population in the villages described nonspecific esterase enzyme expression that was formed inside every individual mosquito. The increase in esterase enzyme on resistant strain was caused by the presence of gene amplification that encode the esterase enzyme (esterase α -2 and esterase α -2), and hence, it causes the general expression percentage enhancement. Selection pressure from the domestic insecticide (pyrethroid) that is used by people enables the nonspecific esterase enzyme enhancement from mosquito population.[18] The resistance mechanism occurs because of the change in the insecticide work target (gene mutation), which causes the increase in detoxification enzyme activity, such as esterase, oxidase, or glutathione-s-transferase blocking that insecticide action.[19]

Conclusions

The mosquito density in Wonosobo District is higher than the standard of DHF control due to the HI (14.75%), CI (6.8%), BI (15.6), and OI (11.30%). Fifty percent of the *Aedes sp* samples collected in Wonosobo District were biochemically tested positive resistant.

The mosquito's capability of being a DHF vector in Wonosobo convinces the belief that DHF transmission occurs even though Wonosobo is a highland area in Central Java Province.

Acknowledgement

We would like to thank the Ministry of Higher Education of Indonesia for funding, local district government of Wonosobo, and all the participants for the help in data collection.

Ethical considerations

This research was done in 2015. We got permission from local government to carry out the research in his area. Ethical clearance got from committee ethic of medicine Faculty of Airlangga University.

Financial support and sponsorship

Ministry of Higher Education of Indonesia had supported funding to this research.

Conflicts of interest

There are no conflicts of interest.

References

- 1 Regis L, Souza WV, Furtado AF, Fonseca CD, Silveira Jr PJ, Melo-Santos MA, *et al.* An entomological surveillance system based on open spatial information for participative dengue control. *An Acad Bras Cienc* 2009;81:655-62.
- 2 Aditama TY. Arah Kebijakan Pengendalian Penyakit Infeksi di Indonesia. Simposium Pengendalian Penyakit Infeksi: Untuk Meningkatkan Kualitas Hidup Bangsa. Sambutan Dirjen P2 and PL Depkes RI dalam Konas VII PIT PAMKI. *Jogyakarta*, 13-14 November 2009.
- 3 Mc Michael AJ, Campbell-Lendrum DH, Corvalan CF, Ebi KL, Githeko AK, Scheraga JD, *et al.* Climate Change and Human Health Risk and Response. Geneva: WHO; 2003.
- 4 Mardihusodo SJ. Manajemen Pengendalian Vektor Demam Dengue. Dalam Simposium Dengue Control Up date. *Jogyakarta*: Pusat Kedokteran Tropis UGM; 2005.
- 5 Uzcategui NY, Camacho D, Cornach G, de Uzcategui RC, Colmes EC, Gould EA. Molecular epidemiology of dengue type 2 virus in Venezuela: Evidence for in situ virus evolution and recombination. *J Gen Virol* 2001;82:2945-953.
- 6 BPS Kabupaten Wonosobo. *Wonosobo Dalam Angka Tahun 2011*. BPS Kabupaten Wonosobo 2012.
- 7 Patz JA, Martens WJ, Focks DA, Jetten TH. Dengue fever epidemic potential as projected by general circulation models of global climate change. *Environ Health Perspect* 1998;6:147-53.
- 8 Widayani P. Pemanfaatan Data Penginde-raan Jauh dan Sistim Informasi Geografi (GIS) untuk Zonasi Daerah rawan Demam Berdarah Dengue. *Workshop Spasial and Temporal Analysis of Malaria Epidemiological Data*. *Yogyakarta*: Fakultas Geografi UGM; 2007.
- 9 WHO. *Vector Control for Malaria and other Mosquito-Borne Diseases*. WHO Technical report Series No. 857. WHO, Geneva; 1995. 91 p.
- 10 Soerono M, Badani AS, Muir DA, Soedono A, Siran M. Observations on doubly resistant *Anopheles aconitus* Donitz in Java, Indonesia, and on its amenability to treatment with malathion. *Bull WHO* 1985;33:453-59.
- 11 Marcombe S, Mathieu RB, Pocquet N, Riaz MA, Poupardin R, Sélor S, *et al.* Insecticide resistance in the dengue vector *Aedes aegypti* from martinique: Distribution, mechanisms and relations with environmental factors. *PLoS ONE* 2012;7:e30989.
- 12 Zulhasril dan Lesmana SD. Resistensi Larva *Aedes aegypti* terhadap Insektisida Organofosfat di Tanjung Priok dan Mampang Prapatan. *Majalah Kedokteran FK UKI* 2010;XXVII:96-107.
- 13 Poison KA, Curtis C, Seng CM, Olson JG, Chantha N, dan Rawlins SC. Susceptibility of two Cambodian populations of *Aedes aegypti* mosquito larvae to temephos during 2001. *Dengue Bull* 2001;25:79-83.
- 14 Tarumingkeng RC. *Insektisida: Sifat, Mekanisme Kerja, dan Dampak Penggunaan*. Jakarta: UKRIDA Press; 1992. 249 hal.
- 15 Shinta S, Supratman S, Fauziah A. Kerentanan Nyamuk *Aedes aedypti* di Daerah Khusus Ibukota Jakarta dan Bogor terhadap Insektisida Malathion dan Lamdachyhalodrin. *Jurnal Ekologi Kesehatan* 2008;7:722-31.
- 16 Sunaryo S, Ikawati B, Rahmawati R, Widiastuti D. Status resistensi vektor demam berdarah dengue (*Aedes aegypti*) terhadap Malathion 0,8% dan Permethrin 0,25% di Provinsi Jawa Tengah. *Jurnal Ekologi Kesehatan* 2014;12:146-52.
- 17 Rashad EM. Esterase activity and detection of carboxylesterase and phosphotriesterase in female desert locust *Schistocerca gregaria* (Forsk.) in relation to tissues and ages. *Egypt Acad J Biol Sci* 2008;11:135-43.
- 18 Widiarti W, Boewono DT, Widyastuti U, Mujono M. Uji Biokimia Kerentanan Vektor Malaria terhadap insektisida Organofosfat dan Karbamat di Provinsi Jawa Tengah dan Daerah Istimewa Yogyakarta. *Penelitian Kesehatan* 2005;33:80-8.
- 19 Lidia K, dan Setianingrum ELSD. Deteksi resistensi nyamuk *Aedes albopictus* terhadap insektisida organofosfat di daerah endemis Demam Berdarah Dengue di Palu (Sulawesi Tengah). *MKM* 2008;03:105-10.

Thursday, January 24, 2019

[Site Map](#) | [Home](#) | [Contact Us](#) | [Feedback](#) | [Copyright and Disclaimer](#)

Resistance Status of aedes sp strain from High Land in Central Java, Indonesia, as an indicator of Increasing Vectors Capacity of Dengue Hemorrhagic Fever

ORIGINALITY REPORT

12%

SIMILARITY INDEX

9%

INTERNET SOURCES

8%

PUBLICATIONS

0%

STUDENT PAPERS

PRIMARY SOURCES

- 1** Martini Martini, Bagoes Widjanarko, Retno Hestningsih, Susiana Purwantisari, Sri Yuliawati. " Population of in Highland of Wonosobo District and Its Competence as A Dengue Vector ", IOP Conference Series: Earth and Environmental Science, 2017
Publication **6%**
- 2** www.scilit.net
Internet Source **3%**
- 3** www.malariajournal.com
Internet Source **2%**
- 4** jurnal.unitri.ac.id
Internet Source **2%**

Exclude quotes Off

Exclude bibliography Off

Exclude matches < 2%

Resistance Status of aedes sp strain from High Land in Central Java, Indonesia, as an indicator of Increasing Vectors Capacity of Dengue Hemorrhagic Fever

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3
