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INTERNATIONAL CONFERENCE ON MATHEMATICS, SCIENCE, AND EDUCATION

"Optimizing The Role of Science and Science Education in Global Cooperation"

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FACULTY OF MATHEMATICS AND NATURAL SCIENCES
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PREFACE

Thanks to God Almighty this International Conference Proceeding could be completed. All articles in this proceeding are presented in International Conference On Mathematics, Science, and Education – Optimizing The Role of Science and Science Education in Global Cooperation on September 19-21st, 2014 at Patra Jasa Semarang Convention Hotel. This Conference is organized by Faculty of Mathematics and Natural Science Facult, supported by Rector of Semarang State University as one of program from Technical Faculty to Achieve UNNES' vision and mission to be one of international campus.

This conference is designed to improve the discussion and research scope in mathematics and science area in the national and international level. Sub topics in this proceeding cover mathematics, applied mathematics, and mathematics education in accelerating character building. Enhancing biology and biology education research for a better life. Green chemistry in research and education. Physics and physics education for trending research.

Hopefully this publication of proceeding will be profitable for all of us.

Regards

Committee of ICMSE

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ICMSE 2014
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VECTOR COMPETENCE OF *AEDES AEGYPTI* ON INCREASING DENGUE TRANSMISSION IN THE HIGLAND OF WONOSOBO SUB-DISTRICT OF CENTRAL JAVA PROVINCE

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ABSTRACT

DHF cases increased significantly in the last years, in the highland of Wonosobo District. In 2009, the incidence reached 59.3/100,000 populations, while in the past years, the incidence was only less than 10/100,000 populations. This study aimed to describe of vector competence and to design a model of DHF transmission dynamics in the highland of Wonosobo District, Central Java Province. The study design used was a cross sectional study. The samples were 20 villages, which were located from 500-1,000 m altitude. Every village was observed about 15 houses. The observed variables were vector competition, physical, social, biology environment, and transovarial infection level. Immnuhistochemical or IHC methods were used to identify the virus. The result of study showed that *Ae. albopictus* was still found in the highland of > 1,000 m asl. The number of *Ae. aegypti* and *Ae. albopictus* were similar and both were found indoors or outdoors. Based on HI and OI index, the larvae density in the highland was higher than standard of the program, especially in the altitude of 500–1.000 m asl. Transovarial infection using immuno-histochemistry (IHC) was found on *Ae. aegypti* and *Ae. albopictus*, 39.7% and 24.2%, respectively. Environment parameters such as temperature and relative humidity in Wonosobo fulfilled the optimum requirement to support the vectors' life cycle. Transovarial infection has been proven to increase DHF incidence in the highland (500-1.000 m asl), thus, it indicates that the local transmission has been occurred in this area. To control the vector population in the highland, it is important to conduct breeding places elimination (PSN) indoors as well as outdoors, through active participation of the community.

Keywords: Dengue Hemorragic Fever, *Aedes* sp, transovarial, highland area

INTRODUCTION

Many Dengue fever is the most serious public health problem in Indonesia. In 2010, there were about 140,000 dengue cases reported. Moreover, it is estimated that 15% of global cases occur in Indonesia (P2B2 Depkes RI, 2011). The disease is caused by dengue virus that is transmitted by the mosquito *Aedes aegypti*; *A albopictus* is a secondary vector. It has the potential to spread quickly.

The pattern of distribution of dengue is influenced by population of the vectors. Many urban areas in the tropical world are subject to dengue transmission, but the geographic range of which is limited by the distribution of the vectors (William, 2010). Humans with high mobility have an important role in distribution of cases among communities (WHO, 2009).

Dengue is prevalent in the Wonosobo District of central Java. In 2009, cases of dengue in Wonosobo District increased greatly over the previous year (< 10/100,000 of population). The reported incidence of

dengue in that year was 50.97 cases per 100,000 of population (468 persons) or Case Fatality Rate (CFR) was 0.43%.

Chandler (1945), Patz (1998) and Widayani (2007) have explained that low temperature could suppress development of *Aedes* so that dengue transsmision would be reduced. This study explained the vector competence and the dynamics of transmission in highland regions based on aspects of vector biology and environmental variables. A model of dynamic transmision of dengue fever the highland is then formulated.

METHODS

This study was an observational survey. The unit of analysis was village. The samples were 20 villages, which were located from 500-1,000 m altitude. Every village was observed about 15 houses. All the containers from the houses that were available indoors and outdoors were examined. We also examined intensively breeding places of vector around the house, natural and human made breeding places. The observed variables were vector competition, physical, social, biology environment, and transovarial infection level. To identify the virus were used Immnuhistochemical (IHC) methods and PCR.

Dengue cases were those recorded by district health officers in 2012. The number of dengue cases was counted based on the prevalence rate. Variables relating to the vectors were measured through entomological surveys using modified ovitraps, larval surveys, and manual trapping of adult mosquitos. Transovarial infection was conducted at the Vector Research Centre Banjarnegara Central Java. Environmental variables were measured by instruments such thermohygrometer, GPS, pH meter and anemometer.

Data were analysed as descriptive method, and the model of trasmission was constructed using pathway analysis.

RESULT

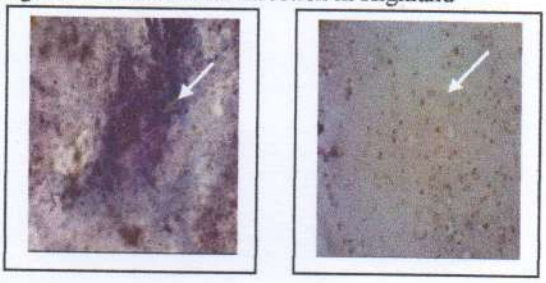
The vector population was estimated with common indices used in the program of vector control. Mean of HI (House Index), BI (Breteau Index), CI (Container Index), and OI (Ovitrap Index). HI (House Index) and OI (Ovitrap Index) are higher than standard program, 8,87% and 20%, respectively.

The preference breeding places of *Aedes* sp were identified in non-bath container, especially dispossible container that scattered around the house and container of water reservoir. While vectors were also mostly found in stem of leaves. Some plants like Bromelia is the preferable place for the mosquito to breed. Four (66.67%) out of the 6 plants positively contained vectors.

Based on ovitrap installed indoor and outdoor, the average of egg per ovitrap was 3.79 (indoor). After rearing from the egg, we could identify the proportion of *Aedes* sp. Population of *Ae. aegypti* dominated (64,7%) indoor, and *Ae. albopictus* dominated (66,3%) outdoor.

To know susceptiblity of mosquitos against the dengue virus done by IHC test. The result showed that transovarial infection had happened in Wonosobo Subdistrict. Figure 1 showed negative and positive the examination result. Both *Ae. aegypti* and *Ae. albopictus* were positively identified using IHC method. However, PCR method has not yet been able to identify positively the virus in the mosquito's body.

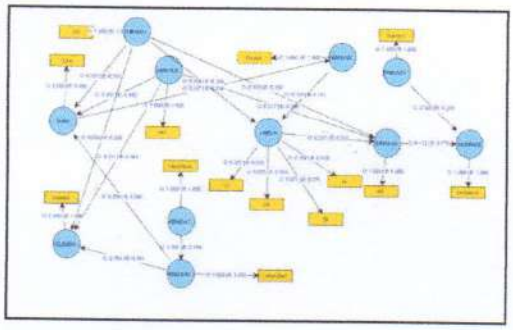
Figure 1: Transovarial Infection in Highland



Model of DHF Transmission

Based on the conceptual scheme, research model of dengue transmission was analyzed using PLS program. The result of analyses modeling with PLS in the highland is as shown in Figure 2. In the model, DHF in the highland was influenced by the adult mosquitos density and high transovarial infection. The mobility and the density of the population in the model has no influence towards the DHF incidence. The parousity percentage of adult mosquitos will determine the vector density, and the vector density can determine the adult mosquitos in the highland area of Wonosobo district.

Figure 2 : Model of Factors related Increasing DHF In Highland Wonosobo



DISCUSSION

Factors related to the increasing of DBD transmission in the highland were mainly in the mosquitos ability to be a vector, the environment change, and the virus strain. The analyses of the mosquito ability to be the vector were viewed from the bionomic

characteristic, reproduction ability, and the susceptibility of the mosquitos towards the dengue virus. Based on the HI, BI, CI, and OI index, the vector density showed the mild category. *Density Figure* (DF) in the highland was about DF=2, which means the contamination risk was in the medium category.

OI measured based on FEDH Hongkong (2003). It was in level 2 (16.2%). Recommendation to control the vector was to give education to community on how to do elimination of breeding places (PSN program) in their area at least once a week.

Environment factor such as temperature and humidity in Wonosobo district contributes to the life of the mosquitos. Temperature would influence the metabolism process, and low temperature would influence the developing egg to larva. On the other hand the increasing temperature could reduce the vector size. The small vector would increase the metabolism process, food consumption, and increase the number egg of the vector (Wongkoon, 2007).

The transovarial infection in Wonosobo District would be a potential new endemic area of DHF if there was no intervension of controlling program intensively from the local health office. Joshi (2002) stated that dengue virus was persistently contaminated by transovarial until the seventh generation (F-7). Transovarial infection have been happened in the highland of Wonosobo District with almost 40% infection level on *Ae. aegypti* while with almost 25% on *Ae. albopictus*. The previous study have identified successfully that there was the strain virus on patient DHF in Wonosobo District Hospital (Martini, et. al. 2012). It was described that 7 out of 20 DHF suspect patients was positively contained of dengue virus (35%) using PCR test. Strain virus were identified from virus strain, namely, DEN-1, DEN-2, DEN-3, and DEN-4. Even, two of them had mixed infection. Kusriastuti (2005) stated that circulating of four stereotype DEN virus the whole year could increase DHF transmission risk. It is worsen by the transovarial infection in Wonosobo District mainly in 500-1.000 m asl.

The model of DHF incidence in the highland in Wonosobo district showed that the incidence was influenced by adult mosquito density and the transovarial infection. Adult mosquitos density was influenced by rainy days, rain fall, and vector density. While vector density was influenced by percentage of vector parousity, and rain fall. Mobility and population density did not influence towards the DHF incidence. Mobility was measured based on interviewing to the responden from the habit of visiting the outside area.

This research was conducted during the end of the rain season. However, there were still the high number of rainy days, and density vector was also still high. This case becomed a early warning system to the Health Provider to stop transmission of DHF due controlling of vector density so that decreasing DHF cases in the area.

High rain fall would contribute to create the new breeding places of the vector. This research did not directly analyse the climate factor towards vector life. Climate factor was verified to influence the life of the larva and the adult mosquitos. Some research did not get relation between climate factor and DHF cases. Dini *et al* (2010) did not get the relation among the climate factors (temperature, rain fall, rainy days, sun exposure, humidity, and wind speed) with DHF incidence in Serang District. On the other hand, a research conducted by Ariati (2013) got the result that climate was one of the factor influencing the DHF. Then, in the rainy season of January to March, temperature is the dominant factor influencing DHF cases, increasing 1°C temperature could decrease number of DHF cases.

CONCLUSION

The model of DHF incidence was shown in the following mechanism: climate factor influence (rain fall, rainy days, and temperature) towards viability of the vector, vector density and the high number of transovarial infection, and then it would determine the increasing of DHF incidence in the highland.

Propotion *Ae. aegypti* and *Ae. albopictus* was almost equal and those species could be found both indoors and outdoor. Environment indicator such temperature and humidity in the highland of Wonosobo district fullfiling the optimum requirements to support vector of DHF life. The average temperature was 28.9°C, and humidity was 71%.

Transovarial infection in the Highland of Wonosobo have been happened, and it had impact emerging of new endemic area and increased potentially DHF incidence that it have ever happened in 2009.

The effort to control the DHF in the highland needs to be improved considering the density of *Ae. aegypti* and *Ae. albopictus* and those vectors have already susceptible towards dengue virus. Education program to the community to do elimination of breeding places of the vector (PSN and 3 M plus program) actively both indoor and outdoor.

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