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The Profile of Mosquito Population of Potential Vector of DHF in Kawengen Village, East Ungaran

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Abstract—*Residents with a history of Dengue Hemorrhagic Fever (DHF) have the potential to be a source of dengue transmission, because of Antibody-dependent Enhancement (ADE) phenomena. East Ungaran district is one of DHF endemic area, in Central Java. Kawengen village has the highest risk of DHF outbreaks in East Ungaran. Important step is needed, to prevent transmission of DHF. By knowing the population profile of male mosquitoes, it can be easily estimated the number of fertile female mosquitoes. This study aimed to know profile distribution of male DHF potential vector in Kawengen village. Population of this study was all of mosquito in Kawengen area. The sample was trapped by Centers for Disease Control and Prevention (CDC) miniature light-trap and taken with total sampling technique. This is qualitative research. Using entomology surveillance through a descriptive observational research approach with cross sectional design. The survey form is using the Magpi 5.5.7 application to collect diversity mosquito, male:female mosquitoes,and vegetation. The results found an* Aedes, Culex, *and* Mansonia. *Proportion male:female of mosquito are* Culex*(67.56%),* Aedes*(29.73%),and* Mansonia*(2.71%). Density of male mosquitoes was lower than female,and vegetation was highly potential as resting also breeding site. So, it is assumed there are low number of fertile female mosquitoes.*

Keywords—male mosquito, proportion, surveillance, density, light trap

I. INTRODUCTION

Dengue virus (DENV) is an agent of Dengue Hemorrhagic Fever (DHF). DHF is transmitted through vector bites. *Aedes aegypti* is the main vector of DHF and *Aedes albopictus* as a potential vector. It is estimated that 40% of the world's population living in tropical and sub-tropical countries has a high risk of DENV infection, with a high mortality rate. The last few decades, shows the global prevalence of DHF tends to increase and be at risk of DHF outbreaks. Indonesia is a tropical country and has a high risk of contracting dengue and outbreaks. The tropical region is a potential habitat for the breeding of DHF vectors, so that DHF transmission is easy to occur [1, 2]

Data on dengue cases at the Ministry of Health of the Republic of Indonesia shows a tendency to increase every year. In various parts of Indonesia, the target achi evement for larvae free numbers has not reached the expected target. The DHF IR target is 51 / 100,000 residents, with CFR <1%. This has caused many regions in Indonesia to be endemic to DHF.

Based on the records at the Semarang City Health Service, the DHF cases in Central Java Province were classified as the highest ranking, CFR 1.61% and IR 23.82. The Semarang area has until now been recorded as one of the endemic areas of DHF. With the highest number of cases in the province of Central Java. It has been noted, since 2006 that IR DBD in the Semarang region is always much higher in Central Java as well as National, and Larva Free Rate (LFR) reports in all areas of Semarang have not been in accordance with the set targets.

One indicator of the success of dengue control, namely the LFR reaches the target of ≥95%. LFR is known in Indonesia in 2018 at 80.09%. LFR reporting in the Province of Central Java 2017 was 84.73% (Central Java Provincial Health Office, 2018). The latest data from Semarang City LFR from April to July 2018 ranges from 84% (Semarang City Health Office, 2018). This condition shows that LFR's achievements in all regions have not met the planned targets. Achievement of LFR target, shows the condition of the area with fewer of breeding sites. So, the potential for transmission of DHF can be categorized as low [2].

Kawengen Village in East Ungaran Subdistrict, including the area in Semarang, which has the potential to occur with DHF outbreaks. This can be seen in the data from the East Ungaran Basic Researh. Its is indicating that Kawengen Village was ranked highest in the population with a history of dengue cases, compared to other villages in the East Ungaran region (Mluweh Village and Kalikayen Village). Although for the diagnosis of dengue the population in Kawengen village is ranked last, after the Kalikayen Village and Mluweh Village. The status of the Kawengen Village with the highest rank in the population with a history of DHF, makes it a high risk of dengue outbreaks. This is related to DENV activity, which has ADE ability and DENV serotype. The possibility of a repeat infection can occur easily. Due to the high number of people with a history of DHF. Repeat infections can trigger outbreaks and accelerate the transmission of viruses in DHF hosts and vectors. Healthy mosquitoes that suck the blood of sufferers or people with a history of DHF, then mosquitoes can infected

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DENV from sufferers / history of DHF [1,3]. The environmental conditions in Kawengen Village also contributed to the potential for outbreaks. Dense areas and varied vegetation potential as breeding sites and abundance of DHF vector populations.

DHF vector population influences the rate of transmission of DHF. DHF vector population is associated with DHF vector mating patterns. Adult male mosquitoes of DHF vectors play an important role in the pattern mate of DHF vector. The proportion of mating between adult male mosquitoes and adult female mosquitoes is 1: 1. Even though the life span of male mosquitoes is shorter than female mosquitoes. Fertile female mosquitoes only do one mate during a lifetime, to fertilize the egg. For this reason, it is necessary to investigate the population or density of male DHF vector mosquitoes. Investigation of the population of male dengue vector mosquitoes, can be done using the Male Mosquito Population Surveillance method. This entomological survey method is a new way to investigate and to observe changes in the population of dengue vector mosquitoes. Male Mosquito Population Surveillance is carried out by using the help of the *Light Trap*. This trap is able to consistently capture male and female dengue vector mosquitoes (*Aedes Aegypti* and *Aedes Albopictus*) [4, 5,9].

With this survey method of dengue vector male mosquito population, it can be used as a basis for obtaining basic information about the entomological indicators of a region. This entomological information can be used for practitioners and policy makers in the prevention and control of dengue in factual and real terms. In addition, data on the population of adult male DHF vector mosquitoes can be used to carry out the Steril insect Technique (STI) program or control mosquitoes by making mosquitoes become sterile.This will have an impact on the reducing mosquito population in a region and preventable dengue cases [3, 6, 7, 8]. The mosquito survey to obtain qualitative entomological data is important for the initial detection of invasive species. Species that are important in the world of public health, especially for the prevention and control of disease transmission. Surveys or monitoring of mosquitoes are carried out routinely to find out the population, at larval and adult stages. Surveys conducted can determine population changes, identify species of mosquitoes, detect mosquito disease vectors, select the right type of vector control to do [8, 9].

II. MATERIAL AND METHODS

This is qualitative research. Using entomology surveillance method through a descriptive observational research approach with cross sectional design. This method is used to determine the diversity of mosquito, proportion of male : female, and vegetation. Population and sample this research was all potential mosquitoes as dengue vectors in Kawengen Village, East Ungaran. Male mosquito population surveillance is carried out by using a light trap to capture DHF vectors. Sample taken using purposive random sampling. There are 5 hamlets in Kawengen village and 39 total of neighborhood Association. Each hamlet is placed 5 light traps. Light trap is filled with attractants (palm sugar fermentation) as well as 1-2 units of insect killer in each placement location. Light traps are placed outside the house or around shrub plants, with a height of 1m from the ground level and a radius of 100 m from the home of DHF cases. The installation of a light trap is carried out for 1 month and monitored every 2 days. The inclusion criteria for placing light trap are permanent habitat for dengue vector in Kawengen Village. The exclusion criteria are: potential breeding sites for mosquitoes has changed in expansion or shrinkage, there will be permanent or temporary puddles within a period of 1 year until the time of the study.

Instruments or tools used in this study include light trap: a tools for mosquito traps, Magpi application 5.5.7: for recording observation sheets, entomology survey sheets, and bottles samples: a places of mosquito sample transport for identification purposes in the laboratory.

Univariate analysis to determine the diversity of mosquito, proportion of male mosquitoes: female, and vegetation. Univariate data analysis displayed in the form of distribution graphics and diagrams

III. RESULTS AND DISCUSSION

This study describe the profile characteristic of male mosquito population in Kawengen village based on species, proportion of male:female, and vegetation. Kawengen village consists of 5 hamlets: Selelu, Jatirejo, Genurid, Kawengen, and Watupawon. A number of 5 light traps were placed in each hamlet, with the determination of the location adjusted for inclusion and exclusion.

Acording to Figure. 1 it can be seen that the distribution of mosquito species in the village of Kawengen is dominated by *Aedes, Culex,* and *Mansonia*. based on research using light traps, in hamlet 2 no trapped mosquitoes were found. Whereas in hamlet 1, hamlet 3, hamlet 4, and hamlet 5 mosquitoes were trapped in the light trap. The number of mosquito species trapped in light traps varies in each hamlet. The calculation of the number of mosquitoes trapped in the light trap is carried out regardless of the sex type of the mosquito. The most *Culex* mosquitoes caught were found in hamlet 5, then hamlet 3, and hamlet 4 was the least found of *Culex* mosquito. *Mansonia* is only found in hamlet 4. In the entomology survey conducted at the indoor breeding site, *Aedes* was found in hamlets 1, hamlet 3, and hamlet 5.

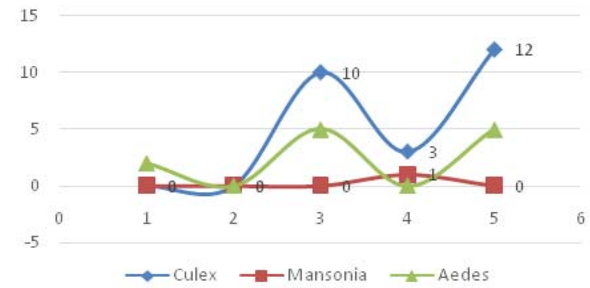

Fig. 1. Mosquito Diversity by Hamlets in Kawengen Village, East Ungaran

The absence of *Aedes* trapped by the light trap in hamlet 2. This condition occurs, is possible due to various things. Including the location of light traps, attractants, environmental conditions in the form of variations in vegetation, electricity that is needed for the light trap to function properly, or mosquito larva eradication program activities carried out by the community. Related with the placement distance of the light trap. In this study the distance of placing a light trap was 100 m from the home of a dengue cases. Even though *Aedes*'s flight distance is estimated at 100 m, there is even literature that states as far as 320 m. But in fact, Hamlets 2 in this study did not find any mosquitoes trapped in the light trap. In addition, the lighting conditions around the location of the light trap placement, also play an important role in attracting mosquitoes to be trapped into the light trap. In conditions of light that is brighter and with high light intensity, the light from the UV lamp contained in the light trap can not attract mosquitoes to enter the trap [10, 11, 12].

The variety of vegetation surrounding the placement of the light trap, acts as a outdoor resting place for mosquitoes. It is possible for mosquitoes to be more interested in resting around the vegetation. Lush vegetation and able to hold water, besides being a resting place, it also has the potential as a breeding place. The largely outdoor resting habit of this species concurs, with its breeding pattern being mainly outdoors. Most of the outdoor resting was observed on vegetation. So that, mosquitoes are not attracted to the light trap. Even though the light trap has been added to the attractiveness of palm sugar fermentation. There is a weakness in using attractants in the form of palm sugar fermentation. Ants and other insects except mosquitoes, are attracted to the light trap. This condition affects the ability of light traps to trap mosquitoes [11, 14].

The results of species identification of mosquitoes trapped by light traps, showed *Aedes, Culex*, and *Mansonia* were found. In this study, there was found a *Aedes* as primary vector transmission of DENV trapped in a light trap. Although the *Culex* and *Mansonia* is not the main vector of DENV transmission, they play an important role in the transmission of other arboviruses. In this study *Aedes* was low numbers found, this condition is in stark contrast to the largely habit known for this species in Asia [10,12,15].

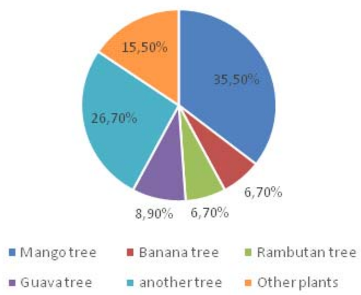

Fig. 2. Distribution of Vegetation in Kawengen

Environmental conditions of the Kawengen village area surrounded by a variety of vegetation. Vegetation distribution can be seen in the Figure 2. The number of banana trees in the Kawengan village was found to be 6.7% of the total vegetation. Banana trees include plants that can hold water. It can potentially be a breeding site for *Aedes* mosquitoes. Kawengen village had an almost 35% of other plants. The Kawengen region is found in many other types of plants, it can potentially be a resting place for mosquitoes. Variety of vegetation affect the existence of *Aedes* Mosquito. The research results showed more numbers of *Culex* and *Mansonia* were found. This condition of course had an effect on the abundance of the *Aedes* population [8, 15,16].

Based on Figure 3. in this study it was known the proportion of mosquito abundance (regardless of sex) in Kawengen villages is 67.56% *Culex*, 29.73% *Aedes*, and 2.71% *Mansonia*. The ratio of the number of male *Culex* mosquitoes: females caught by light traps in the village of Kawengen is 4:21. The *Mansonia* mosquito found trapped in a light trap, only a female type. Whereas for *Aedes* assumed most number of female mosquitoes were found, male : female was 1:10. More female mosquitoes are trapped by light traps than male mosquitoes. This can be said that the female mosquito population is higher than the male mosquito population. This condition occurs in various species of mosquitoes that have been found.

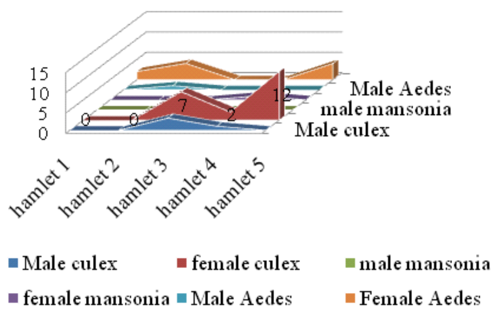

Fig. 3. Proportion of male and female mosquitoes diversity in Kawengen village

Male mosquito populations that are far less than the female population. Have an influence on the density and changes in mosquito populations. In conducting mating, the proportion of male mosquitoes : female mosquitoes is 1: 1. Although the length of life of female mosquitoes is more longer. Fertile female mosquitoes only need one mate during their lifetime, to fertilize the egg. Whereas in female mosquitoes vertical transmission can occur. Fertile female mosquitoes infected with DENV, can transmit the virus to the next generation through eggs through the ovarian wall. In the indoor breeding site entomology survey, it was estimated that the proportion of DENV vector male mosquitoes ranged from 9.1% of the total population of *Aedes*. The mosquito eggs will not hatch, if they are not fertilized by male mosquitoes. So that, the abundance of male populations plays an important role in the fertility and fecundity of female mosquitoes [8, 9, 17].

The proportion of the population of male *Aedes* mosquitoes in the Kawengen village, including in the low category. Nonetheless, should be aware for the possibility explotion of the population of *Aedes* mosquitoes. Many factors give an effect on population explosion or the density of *Aedes*. The use of household insecticides can affect fluctuations in the mosquito population. In the study of differences in the rates of fecundity, fertility, and viability of mosquitoes, on exposure insecticide-susceptible and resistant. Found that mosquito that has been exposed, will effect on fecundity, fertility and adult emergence. Especially if females have blood fed before exposed with insecticide. It is effect on egg-hatching and may increasing the number of eggs. And indirectly can influence an extend the life of the mosquito. The number of eggs hatched by mosquitoes can result in increased mosquito density. High mosquito density, will increase the frequency of looking for feed. Especially female mosquitoes, will be increasingly more frequent for sucking blood. This blood is needed for the maturation of the eggs to be hatched. Increased frequency of blood sucking, can increase the speed of transmission of DENV [17, 18, 19, 20].

IV. CONCLUSION

The results of the study, show that in the Kawengen village were found : *Aedes, Culex,* and *Mansonia* mosquitoes. The population ratio of male mosquitoes is lower than female mosquitoes (in various species). There is a variety of vegetation that has the potential as a resting place and a breeding site (banana tree) for mosquitoes in Kawengen village.

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