Short Communication:
Diversity of mosquitoes in Central Java, Indonesia that act as new vector in various tropical diseases

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Abstract. Khariri, 2018. Short Communication: Diversity of new mosquitoes in Central Java Province that can act as vector in various tropical diseases. Bonorowo Wetlands 2: 71-74. There are many diseases which are transmitted by mosquitoes as vectors. The presence of mosquitoes is widespread throughout the world including in Indonesia with an estimated 3100 species from 34 genera. Vector control is the main thing to do in addition to treatment in patients. Morphological identification of mosquitoes aims to identify the character and number of species so that it becomes a picture of diversity in an area. Data collection was carried out by collecting data from the 2015 Special Research Report on Vector and Reservoir Diseases (Rikhus Vektor) in Central Java Province. The data obtained were analyzed descriptively. Mosquito samples in Rikhus Vektor in 2015 in Central Java Province were collected from 3 different ecosystems, namely forest (H), non-forest (NH) and beach (P). The location of the ecosystem includes near settlements (DP) and far from settlements (JP). Mosquito samples were successfully identified as many as 29,071 tails consisting of 5 genera and 37 species. From Pekalongan, a sample of mosquitoes consisting of 5 genera and 19 species was obtained. As many as 4 species of mosquitoes are species that have never been identified and reported circulation in Pekalongan. Identification of mosquitoes collected in Purworejo has 5 genera and 23 species. Mosquito samples from Pati were identified as having 5 genera and 22 species.

Keywords: Central Java, mosquitoes, tropical diseases, vectors

INTRODUCTION

Insects can play a positive role in human life, but there are also insects that harm human health (Sabir et al. 2017). Mosquitoes are one type of insects that are small that harm human health because they act as disease vectors. Some diseases that are caused by mosquitoes are still a serious health problem in society with the many losses incurred (Islamiyah et al. 2013). The presence of mosquitoes is widespread throughout the world including in Indonesia with an estimated 3100 species from 34 genera. Some mosquitoes that became disease vectors include Aedes aegypti and Aedes albopictus causing Dengue Hemorrhagic Fever (DHF) and chikungunya, 19 mosquitoes from the Anopheles genus causing malaria, 27 mosquitoes from the genus Culex, Anopheles, Aedes and Mansonia causing filariasis (Marbawati and Sholichah, 2009).

At present there have been many reports of diseases that are transmitted by mosquitoes as vectors. The many losses caused by the disease so that an effort to eradicate the disease needs to be done (Sabir et al. 2017). Eradication of disease through vector control programs is the main thing to do in addition to treatment in patients (Kazwani and Mading, 2014). Mosquito control programs as disease vectors will be maximized if there is a match between the behavior of mosquitoes that are targeted by the control methods used (Mahdalena et al. 2016). Mosquitoes have a high diversity of species with habitat for female breeds which are very diverse, ranging from semi-aquatic places to wide water systems (Suwito, 2007). The proper morphological identification of mosquitoes can be used to identify the character and number of species so that it becomes a picture of diversity in an area (Fahmi et al. 2014).

Indonesia is an archipelago that has a tropical climate that is heterogeneous and vulnerable to the impacts of regional and global climate change. Macro and microclimate changes can affect the spread of infectious diseases, including infectious diseases of mosquito vectors. Increased humidity and rainfall are directly proportional to the increase in mosquito density, while the temperature has an optimum limit for mosquito breeding between 25-27°C. Central Java Province is still an endemic area for several diseases transmitted by mosquitoes as a vector (Suwito et al. 2010).

MATERIALS AND METHODS

Analysis was carried out on data from the 2015 Special Research Report on Vector and Reservoir Diseases (Rikhus Vektor) in Central Java Province, Indonesia (MoH 2015). The collection of mosquito samples was carried out in 3 districts in Central Java, namely Pekalongan, Purworejo, and Pati. Mosquito samples were collected from 3 different ecosystems, namely forest (H), non-forest (NH) and beach (P). The location of the ecosystem includes near settlements (DP) and far from settlements (JP). Mosquito
samples were identified and tested in the laboratory to
confirm the species and disease agents they brought.
Laboratory checking using Polymerase Chain Reaction
(PCR) includes dengue, malaria, chikungunya, JE and
filariasis for mosquito samples. The data obtained were
analyzed descriptively.

RESULTS AND DISCUSSION

Mosquitoes samples were identified and tested in the
laboratory to confirm the species and disease agents they
brought. Laboratory tests were carried out using the
Polymerase Chain Reaction (PCR) method for the
detection of DHF, malaria, chikungunya, Japanese
cephalitias (JE) and filariasis. The total samples of
mosquitoes that were successfully identified were 29,071
tails consisting of 5 genera and 37 species. From
Pekalongan District, there were mosquito samples
consisting of five 5 and 19 species, from Purworejo District
consisting of 5 and 23 species and from Pati District
consisting of 5 and 22 species. Complete results can be
seen in Table 1.

Four species of mosquitoes among the 24 species found
in Pekalongan District are species that have never been
identified and reported in Pekalongan District, namely
Aedes sub genus finlaya, Ar. durhami, Ar. kucingensis, and
Ar. pectinatus. The results of laboratory tests on samples
collected from Pekalongan District obtained positive Aedes
aegypti containing DHF virus as much as 26.7%, while
malaria, Japanese encephalitias (JE) and filariasis
examinations were negative. In samples collected from
Purworejo District and Pati District, the results of
laboratory tests for the detection of dengue virus, Japanese
encephalitias (JE), malaria and filariasis showed negative
results.

Almost all regions in Central Java except Wonosobo
become deadly disease-endemic areas, namely DHF. The
highest cases of elephantiasis or filariasis in Central Java
occur in Pekalongan City. The Central Java Provincial
Health Office reported that there were 442 cases of
filariasis in the May 2017 period occurring in Pekalongan
City. This figure far exceeds the cases occurring elsewhere
in Central Java which only reach two digit numbers.

DHF becomes a health problem that is prioritized in
Central Java Province because DHF cases are still the third
highest in Indonesia in 2015 (Fatati 2017). Pekalongan
District is one of the regions in Central Java Province
which has a serious problem of dengue disease. Pekalongan
District Health Office has reported that Incidence Rate (IR)
of DHF in Pekalongan District trends to increase every year.
In 2012 it increased to 15.17 / 100,000 population and
increased again in 2013 to 33.6 / 100,000 population
(Widiastuti and Ikawati, 2016).

Pekalongan District is also one of the regencies in
Central Java Province which is included in filariasis-
endemic areas. Pekalongan District Health Office has
reported the number of chronic filariasis cases continues to
increase in 2011. All mosquito species can play a role as
infectious filariasis. More than 23 species of mosquitoes
are estimated to occur in Indonesia and become filariasis
transmission vectors consisting of the genera Anopheles,
Aedes, Culex, Mansonia, and Armigeres. Someone will
show symptoms of filariasis with several bites of
mosquitoes that have been infected with filaria for a long
time.

Purworejo District is the place in Central Java Province
with the highest number of DHF patients in Java. Data
from Purworejo District Health Office stated that dengue
cases often appear in Purworejo District and are
increasingly widespread with relatively high IR and CFR.
The number of dengue cases continues to increase until
2016 to 447 cases with morbidity rates of 58 / 100,000
population. This number still exceeds the national figure of
20 / 100,000 population (Yana, 2017). The highest malaria
case in Central Java also occurred in Purworejo District. A
total of 6 sub-districts from 16 sub-districts in Purworejo
District were included in malaria-endemic areas. This
amount is the highest number of districts that have malaria
endemic in Central Java Province. The six sub-districts are
Bener, Bagelen, Gebang, Loano, Kaligesing and Kemiri
Sub-districts (Lestari et al. 2007).

DHF is still a serious problem in Pati District, as
evidenced by 29 existing health centers that have been
infected with DHF. DHF morbidity rate in Pati District in
2015 amounted to 74.9 / 100,000 population increased
compared to 2014 amounting to 23.2 / 100,000 population.
The highest morbidity rate in Kayen with 43 cases and the
lowest in Tayu I Health Center was not found in DHF
cases. Every DHF patient who reported treatment was
carried out, epidemiological investigations in the field and
control efforts.

A report from the Pati District Health Office in 2015
stated that morbidity is an indicator to monitor the progress
of malaria. The number of clinical malaria sufferers in Pati
District in 2015 was 82 people with positive malaria as
many as 56 down compared to 2014 as many as 312 people
with positive malaria 118 people. Malaria morbidity in Pati
District is more due to migration from endemic areas to
Pati District. In 2015 filariasis cases were found as many as
1 person and up to 2015 in Pati District, there were 14
cases (1 / 100,000 population).

Changes in global temperature will affect climate
change and will increase environmental health risks for
humans. Exposure to environmental changes can cause
various health problems, one of which is related to disease
vectors (Yanuarini 2015). Malaria is an infectious disease
that is sensitive to climate change. It is estimated that the
average global temperature will increase by 1.0° - 3.5°C by
2100 which will increase the number of vector-borne
diseases and the transmission of disease. Climate change
will have a long-term and short-term impact on malaria
transmission. In the short term, it can be seen in
temperature and rainfall (Githeko 2000).
Table 1. Distribution of species and number of mosquitoes caught based on ecosystems

| Species                  | HDP | HJP | NHDP | NHJP | PDP | PJP | Total |
|--------------------------|-----|-----|------|------|-----|-----|-------|
| *Aedes aegypti*          | 0   | 0   | 58   | 2    | 13  | 1   | 74    |
| *Aedes albopictus*       | 17  | 131 | 97   | 91   | 22  | 12  | 450   |
| *Aedes pollicitus*       | 0   | 44  | 0    | 0    | 0   | 0   | 44    |
| *Aedes scutellaris*      | 0   | 7   | 0    | 0    | 0   | 0   | 7     |
| *Aedes sp.*              | 100 | 2   | 2    | 0    | 0   | 10  | 114   |
| *Aedes sub genus finlaya*| 0   | 2   | 0    | 0    | 0   | 0   | 2     |
| *Aedes vexans*           | 0   | 0   | 0    | 10   | 0   | 45  | 55    |
| *Anopheles aconitus*     | 19  | 2   | 1    | 1    | 0   | 0   | 23    |
| *Anopheles annularis*    | 20  | 9   | 1    | 0    | 0   | 0   | 30    |
| *Anopheles balabacensis* | 1   | 34  | 0    | 0    | 0   | 0   | 35    |
| *Anopheles barbirostris* | 154 | 62  | 47   | 267  | 12  | 17  | 559   |
| *Anopheles leucophyllus* | 3   | 0   | 0    | 0    | 0   | 0   | 3     |
| *Anopheles indfinitus*   | 2   | 0   | 2    | 1    | 218 | 9   | 232   |
| *Anopheles kochi*        | 25  | 1   | 0    | 4    | 0   | 0   | 30    |
| *Anopheles maculatus*    | 567 | 191 | 0    | 0    | 0   | 0   | 758   |
| *Anopheles peditaeniatius* | 207| 0   | 0    | 0    | 0   | 0   | 207   |
| *Anopheles tessellatus*  | 0   | 0   | 0    | 1    | 0   | 0   | 1     |
| *Anopheles subpictus*    | 2   | 0   | 12   | 7    | 847 | 1124| 1992  |
| *Anopheles vaga*         | 54  | 0   | 4    | 35   | 188 | 14  | 295   |
| *Armigeres durhami*      | 3   | 1   | 0    | 0    | 0   | 0   | 4     |
| *Armigeres kucingenisis* | 25  | 33  | 2    | 10   | 3   | 0   | 73    |
| *Armigeres pectinatus*   | 1   | 3   | 0    | 0    | 0   | 0   | 4     |
| *Armigeres sp.*          | 1   | 0   | 0    | 0    | 0   | 0   | 1     |
| *Armigeres subhalbatus*  | 51  | 9   | 118  | 731  | 57  | 1   | 967   |
| *Culex bitaeniorhyncus*  | 0   | 5   | 1    | 18   | 1053| 604 | 1681  |
| *Culex fuscoccephalus*   | 0   | 2   | 0    | 0    | 6   | 3   | 11    |
| *Culex gelidus*          | 4   | 0   | 4    | 4    | 160 | 15  | 187   |
| *Culex hutchinsoni*      | 0   | 0   | 0    | 2    | 0   | 0   | 2     |
| *Culex pseudovishnai*    | 920 | 113 | 54   | 936  | 206 | 536 | 2765  |
| *Culex quinquefasciatus* | 126 | 10  | 810  | 562  | 1299| 572 | 3379  |
| *Culex sp.*              | 2   | 1   | 0    | 0    | 0   | 0   | 3     |
| *Culex tritaeniorhyncus* | 1854| 373 | 524  | 2507 | 1165| 530 | 6953  |
| *Culex vishnai*          | 1086| 363 | 251  | 1944 | 275 | 1230| 5149  |
| *Culex sitiens*          | 0   | 0   | 0    | 0    | 304 | 2370| 2674  |
| *Mansonia uniformis*     | 0   | 7   | 0    | 5    | 9   | 0   | 21    |
| *Mansonia divers*        | 1   | 6   | 1    | 0    | 146 | 131 | 285   |
| *Malaya sp.*             | 1   | 0   | 0    | 0    | 0   | 0   | 1     |
| Total                    | 5326| 1411| 1989 | 7136 | 5985| 7224| 29071 |

Hot and humid air is most suitable for Anopheles mosquitoes. Anopheles mosquitoes used to appear more frequently in the transition season, but mosquito attacks can be found for most of the year (Duarsa, 2008). Mosquito species that become malaria vectors have habitats that are influenced by environmental temperature, vegetation, altitude or topography, food availability and even some subspecies that are affected by water pH and salinity. If the life of a human being is in contact with the habitat of *Anopheles mosquitoes*, there is a risk of transmission. Mosquitoes breed well if the environment is in accordance with the conditions needed by mosquitoes to breed. Environmental conditions that support the development of mosquitoes are not the same for each type/species of mosquito. *Anopheles aconitus* mosquitoes are suitable in hilly areas with non-technical terraced rice fields, many water channels overgrown with grass that inhibit the flow of water (Harijanto 2009). *Anopheles balabacensis* mosquitoes are suitable for hilly areas that are widely found in forests and plantations. Geographical and meteorological factors in Indonesia are very beneficial for malaria transmission in Indonesia. The effect of this temperature is different for each species. At a temperature of 26.7°C the extrinsic incubation period is 10-12 days for *P. palcifarum* and 8-11 days for *P. vivax*, 14-15 days for *P. malariae* and *P. ovale* (Yawan 2016). Malaria transmission includes three main factors, namely patients with or without clinical symptoms, mosquitoes or vectors, and healthy humans. The physical, chemical, biological, and socio-cultural factors of the local community greatly influence the spread of malaria. The interaction of weather and climate change, pond excavation, deforestation, and areas with lots of puddles,
bushes, and an unhealthy environment will affect the growth of malaria agents (Hasyim 2014).

Changes in temperature, relative humidity, and rainfall resulted in mosquitoes laying more frequently and increasing the number of DHF vectors and viruses to develop more malignantly. The cycle of marriage and the growth of mosquitoes from eggs to larvae and adult mosquitoes will be shortened so that the population will quickly rise. The presence of water reservoirs such as bathtubs, flower vases, drums, used cans, etc. will increase the number of mosquito laying eggs (Gama 2010).

Around 400 species of Anopheles mosquitoes have been found around the world and 67 species have been proven to be malaria vectors. Among 67 mosquito species, there are 22 species found in Indonesia (Munawar 2005). In Indonesia there are 80 species of Anopheles mosquitoes, 19 species of which have been confirmed as malaria vectors and more than 23 species of mosquitoes become filariasis transmission vectors consisting of the genera Anopheles, Aedes, Culex, Mansonia and Armigeres. Environmental factors are one that affects filariasis vector density. The presence of Aedes aegypti in an area is an indicator of the presence of Aedes aegypti population in the area. The ideal environment for mosquitoes can be used as a potential place for mosquito breeding and resting places so that the density of mosquitoes will increase.

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