The study of fauna and vectorial competency of mosquito (Diptera:Culicidae) at Satu’un Village, Muara Uya Subdistrict, Tabalong District, South Kalimantan Province

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ABSTRACT

In Indonesia, mosquito-transmitted diseases such as malaria, dengue haemorrhagic fever (DHF), and filariasis, still become main public health problems. Mosquito species which usually act as disease vector are Aedes sp, Culex sp, Anopheles sp and Mansonia sp. The aim of this study was to comprehend the mosquito fauna, bionomical and vector competence of Aedes sp, Culex sp, Anopheles sp and Mansonia sp at Santu’un Village, Muara Uya Subdistrict, Tabalong District, South Kalimantan Province. Man Biting method using aspirator was used to capture mosquitoes. Mosquito dissection, ELISA and immunohistochemistry were performed to find microfilaria larvae, sporozoit Sp. of Plasmodium and dengue virus, respectively. The results showed that Cx.quinquefaciatus, Cx.tritaeniorhyncus, Cx.pipiens and Cx.gelidus were exophagic. Culex quinquefaciatus and Cx.tritaeniorhyncus biting activity was began at 7 – 8 pm with their biting rate were 102.5 and 44.5 mosquitoes/person/night, respectively. Anopheles umbrosus was endophagic. Its biting activity peaked at 8 – 9 pm with its biting rate was 0.5 mosquito/person/night. Meanwhile, An. nigerimus and An.kochi were exophagic. The biting activity of An.nigerimus peaked at 8 – 9 pm with its biting rate was 0.5 mosquito/person/night. Anopheles kochi biting activity peaked at 6 – 7 pm with its biting rate was 1.5 mosquito/person/night. Aedes albopictus was found at 6 - 7 pm with its biting rate was 2.5 mosquitoes/person/night. Mansonia bonea was exophagic. Its biting activity peaked at 11 – 12 pm with its biting rate was 2 mosquitoes/person/night. The average temperature and humidity of this study were 26.14 ± 0.30 o and 94.60 ± 0.48%, respectively. Culex sp. usually rested inside the house in the morning. The breeding places of mosquitoes were puddle of water near house, water container, old/unused vehicles, footprint, and water tank. The water temperature of the breeding place was 25 oC. Its pH was 5.6 with 0 per mil salinity. This study did not found the vector of malaria, DHF, and filariasis. In conclusion, four genera of mosquitoes i.e. Culex, Anopheles, Aedes and Mansonia were found at Santu’un Village. However, vectors of malaria, DHF and filariasis were not found at this village.

Key words : Culex - Anopheles - Aedes – Mansonia - fauna - vector

ABSTRAK


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Kata kunci : Culex - Anopheles - Aedes – Mansonia - fauna - vektor

INTRODUCTION

Santu’un Village is one of 11 villages which are located at Muara Uya Subdistrict, Tabalong District, South Kalimantan Province. This village has been categorized as malaria endemic area. In 2008-2009, the Annual Parasite Incidence (API) at Muara Uya Community Health Center was 2.82 per 1000 persons. Moreover, one chronic filariasis and 23 DHF cases were also found and two deaths from DHF were reported in 2008-2009. The control and management of vector-borne diseases have not been conducted at that village. These cause the number of mosquito-borne diseases especially malaria, DHF, and filariasis was quite high. Therefore, study in order to comprehend the species of mosquitoes that inhabit in Muara Uya Subdistrict, as well as the bionomic and the vector competence is needed. This study was conducted to comprehend the mosquitoes fauna, bionomical and vectorial competency of mosquitoes in Muara Uya Subdistrict.

MATERIALS AND METHODS

This study was an observational research using descriptive method. The measurement of temperature and humidity was conducted using thermometer and hygrometer, respectively. Global Positioning System (GPS) was used to measure the height of position. Survey of mosquito larvae was also performed. Mosquito capturing by Man Biting method using aspirator was performed at 6.00 pm – 6.00 am. The mosquito capturing was conducted by six persons at three houses which have been determined. Three persons captured the mosquitoes inside the houses and in the walls (indoor mosquito). Meanwhile, the other three persons captured the mosquitoes outside the houses and at the livestock cage (outdoor mosquito). The mosquitoes capturing was conducted once a month for 4 months.

The dissection of mosquito was performed to find the microfilaria larvae. Enzyme-Linked Immunosorbent Assay (ELISA) of Plasmodium sporozoit of Anopheles sp was performed by using A Two-Site Sandwich technique. The examination of dengue virus was performed by examining head squash preparats using immunohistochemistry which was previously described by Umniyati. Descriptive analysis was conducted to make description of variables condition.

RESULTS

During this study, the average temperature and humidity were 26.14 ± 0.30°C and 94.60 ± 0.48 %, respectively. The frequency of captured mosquitoes is shown in TABLE 1.

<table>
<thead>
<tr>
<th>Genera</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anopheles</td>
<td>28</td>
<td>8</td>
<td>4</td>
<td>0</td>
<td>21</td>
<td>61 (5.7)</td>
</tr>
<tr>
<td>Culex</td>
<td>224</td>
<td>221</td>
<td>83</td>
<td>52</td>
<td>350</td>
<td>945 (89.2)</td>
</tr>
<tr>
<td>Mansonia</td>
<td>2</td>
<td>19</td>
<td>16</td>
<td>1</td>
<td>3</td>
<td>41 (3.9)</td>
</tr>
<tr>
<td>Aedes</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>8 (0.8)</td>
</tr>
<tr>
<td>Armigeres</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>4 (0.4)</td>
</tr>
<tr>
<td>Total</td>
<td>256</td>
<td>249</td>
<td>106</td>
<td>56</td>
<td>379</td>
<td>1.059 (100)</td>
</tr>
</tbody>
</table>
The biting activity of indoor mosquito indoor is shown in FIGURE 1. The biting activity of *Cx. quinquefaciatus* and *Cx. tritaeniorhynchus* was started at 18.00 and peaked at 21.00-22.00, with biting rate of 52 mosquitoes/person/night. Meanwhile, the biting activity of *Cx. tritaeniorhynchus* was started at 23.00-24.00 with biting rate of 24.5 mosquitoes/person/night. This study also reported that the biting activity of *An. umbrosus* was at 20.00-21.00.

Anopheles nigerimus and *An. kochi* were only can be found at early night, and their biting rate were 0.5 mosquito/person/night for *An. nigerimus* and 1.5 mosquitoes/person/night for *An. kochi*. Meanwhile, *Ae. albopictus* biting activity was at 23.00-24.00. The peak biting activity of *Man. uniformis* was at 20.00-21.00 and its biting rate was 4.5 mosquitoes/person/night. While *Man. bonea* biting activity was at 21.00-22.00 with its biting rate was 2 mosquitoes/person/night.

The biting activity of outdoor mosquito is shown in FIGURE 2. The biting activity of *Cx. quinquefaciatus* and *Cx. tritaeniorhynchus* was started from 18.00 and reached its peak at 19.00-20.00. The biting rate of both mosquitoes was 102.5 mosquitoes/person/night. Meanwhile, *Cx. tritaeniorhynchus* biting activity was at 22.00-23.00. The biting rate of this mosquito was 44.5 mosquitoes/person/night. *Culex pipiens* biting activity began at 22.00 and peaked at 24.00-01.00. Its biting rate was 13 mosquitoes/person/night.

*Anopheles nigerimus* and *An. kochi* were only can be found at early night, and their biting rate were 0.5 mosquito/person/night for *An. nigerimus* and 1.5 mosquitoes/person/night for *An. kochi*. Meanwhile, *Ae. albopictus* biting activity was at 23.00-24.00. The peak biting activity of *Man. uniformis* was at 20.00-21.00 and its biting rate was 4.5 mosquitoes/person/night. While *Man. bonea* biting activity was at 21.00-22.00 with its biting rate was 2 mosquitoes/person/night.
The number of mosquito which was captured at the walls is shown in FIGURE 3. At night, *Cx. quinquefaciatus* was found to rest or sleep at walls. The biting rate of *Cx. quinquefaciatus* was 154 mosquitoes/person/night and it was higher compared to the biting rate of *Cx. tritaeniorhynchus* and *Cx. pipiens*. *Anopheles sp* which was captured at walls were *An. umbrosus*, *An. barbirostris* and *An. kochi*. *Ae. albopictus* was found resting or sleeping at walls at 23.00-24.00. The biting rate of *Ma. bonea* was 4 mosquitoes/person/night, while the biting rate of *Ma. uniformis* was 2 mosquitoes/person/night.

![FIGURE 3. The number of Culex sp, Anopheles sp, Aedes sp, Mansonia sp which were captured at the walls at Santu’un Village, Muara Uya Sub district from September 2010 – January 2011](image)

The number of mosquito which was captured at livestock cages is shown in FIGURE 4. *Culex quinquefaciatus* could be found at livestock cages at 23.00-24.00. Its biting rate was 164 mosquitoes/person/night. *Anopheles sp* which was captured at livestock cages were *An. umbrosus*, *An. vagus*, *An. kochi*, *An. maculatus*, *An. tesselatus*, *An. nigerimus*, *An. sundaicus*, and *An. barbirostris*. Most of *Anopheles sp* which were found at livestock cages were *An. kochi* and its biting rate was 54 mosquitoes/person/night. *Aedes sp* which were found at livestock cages were *Ae. vexian* and *Ae. lineatopenis*. *Mansonia bonea* and *Man. uniformis* also could be found at livestock cages.

![FIGURE 4. The number of Culex sp, Anopheles sp, Aedes sp, Mansonia sp which were captured at livestock cages at Santu’un Village, Muara Uya Sub district from September 2010 – January 2011](image)
DISCUSSION

Anopheles umbrosus, An. nigerimus and An. maculatus were suspected as vectors of malaria from six species of Anopheles sp which were assumed as malaria and filariasis vectors at South Kalimantan Province. In this study, An. umbrosus was endophagic, while An. nigerimus and An. kochi were exophagic. Anopheles barbirostris was found to sleep and rest at walls. It was active both inside and outside the house with its biting activity peaked at 22.00-24.00.7

In this study, An. maculatus was found to rest at walls of houses. This mosquito preferred to bite animal than human, or zoophilic.8 Anopheles sundaicus and An. vagus could be found near the livestock cages. Anopheles sundaicus was reported as malaria vector at other provinces, such as Yogyakarta, Riau, Lampung, Central Java, and East Java.6 Anopheles vagus was also reported as malaria vector at other regions.9 This mosquito preferred to bite animal than human and commonly bite human at outside the house.10

Aedes lineatopenis was endophagic. Meanwhile, Aedes albopictus was exophagic and more active outside the house with its main host was human.11 Aedes albopictus was the vector of dengue (DHF).6 Its biting activity was at 08.00-12.00 in the morning and 15.00-17.00 in the afternoon.12 However, this study reported that Aedes albopictus bit at night.

Mansonia uniformis was endophagic while Mansonia bonea was more exophagic. Both species were the vector of filariasis at South Kalimantan Province.12 This result was in accordance with the study by Lasbudi13 which found that Mansonia uniformis and Mansonia bonea were active to bite human, either inside or outside the house. Mansonia sp was categorized as nocturnal mosquito which bite at night and its biting activity occurred from 12.00 to 03.00 a.m.

Culex sp which was captured when it rest inside the house in the morning were Cx. quinquefasciatus, Cx. tritaeniorhynchus and Cx. pipiens. During this study, there was no Anopheles sp, Aedes sp and Mansonia sp were captured in the morning, either inside or outside the house.

The result of mosquitoes dissection did not found any larvae of filariasis worm. This result might be caused by the small number of contact between human with Culex sp and Mansonia sp, especially Cx. quinquefasciatus, Ma. uniformis and Man. bonea, which were suspected as the vector of filariasis. The density, mosquito live span, and contact with human are the requirements of mosquitoes to become vector of filariasis. The infection of filariasis from mosquitoes to human is very different with the infection of malaria and dengue (DHF) to human. An individual could be infected by filariasis when she/he is bitten thousand times by vector mosquitoes.14 This study did not perform ovary surgery to determine the age of mosquito. To act as the vector of filariasis, mosquitoes should have long life span, therefore the parasite could complete its life cycles in the mosquito. Furthermore, the number of microfilaria density in chronic filariasis patients was not identified. According to Sudjadi,15 the minimum number of microfilaria in order to infect the vector and became contagious to other person was 15 microfilaria per 30 mm3.

In this study, ELISA did not find any sporozoite in the body of Anopheles. This result might be caused by the low number of contact between mosquito and human, the short life span of Anopheles, or the low average of Plasmodium gametocyte of Anopheles. Based on the data of mosquito-capturing in the night, only five Anopheles mosquitoes were reported to bite human. Anopheles could be suspected as malaria vector when there is high number of contact between this mosquito with humans, when the mosquito sucks blood for 2-3 times a day, and when the mosquito has long life span, therefore gametocyte could develop into sporozoite.16

This study only used small number of larvae stadium of Aedes albopictus which could explain the cause of negative result of immunohistochemistry of Aedes albopictus. The small number of larvae stadium of Aedes albopictus was caused by the low survival rate of Aedes albopictus imago in the laboratory. This factor became the weakness of this study. There was a difference in the transovarial infection rate (TIR) between egg, larvae, pupa, and imago stadiums. Larvae had the lowest TIR of DEN infection rate (TIR) between egg, larvae, pupa, and imago stadiums. Larvae had the lowest TIR of DEN virus (22%) while imago had the highest TIR of DEN virus (96%).17

Three important factors which play role in the transmission of DEN virus infection are human, virus, and the vector.18 Mosquito is infected by DEN
virus when it bites human whose blood contains DEN virus. The vertical transmission in mosquito happens when DEN virus is transmitted by infective female mosquito to its eggs (transovarial) that will become adult mosquito.19-21

The breeding places of Culex sp larvae were dirty water pond and water container. Anopheles larvae were found in water in old vehicle or unused vehicle, foot print, and water tank which grown by large frog and lily pad. Aedes sp larvae were found at unused tires and drums which often used to collect rainwater. Different species of mosquitoes choose different breeding places.22

CONCLUSION
This study showed that :
1. The genera of mosquitoes which were found in this study were Culex, Anopheles, Mansonia and Aedes. Culex quinquefaciatus, Cx. tritaeniorhyncus, Cx. pipiens, and Cx. gelidus were exophagic. Anopheles umbrosus was endopagic, while An. nigerimus and An. kochi were exophagic. Mansonia uniformis was endophagic while Ma. bonea was exophagic.
2. The mosquito biting activity and biting rate were different depending on the genera of mosquitoes.
3. The breeding places of mosquitoes were at puddle of water near the house, water container, unused vehicle, foot print, and water tank. The water temperature of those breeding places was 25°C with the pH of the breeding places was 5.6 and 0 per mil salinity.
4. This study did not found mosquitoes as vector of malaria, dengue (DHF), and filariasis.

Further study to determine the disease vector is needed. The study in order to evaluate the fluctuation of vector density based on rainfall, peak season of the disease, and other factors which contribute in determining the malaria, DHF and filariasis vectors are also needed.

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REFERENCES


