Distribution and ecology of mosquito larvae in Pahandut sub-district, Palangkaraya city

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Abstract. Mosquitoes are vectors for several diseases, such as dengue fever, malaria, Japanese encephalitis, and chikungunya. This study aimed to navigate and analyze the presence of mosquito larvae in the environment of Pahandut District collected and documented from Langkai, Panarung, Pahandut, Tanjung Pinang, Pahandut Seberang, and Tumbang Rungan urban village in Pahandut Sub-District. The collected samples were examined in Biomedic Laboratory, Faculty of Medicine, Palangka Raya University. The distribution larvae was dominated by Culex quinquefasciatus which was 20.89% in Langkai urban village, Culex quinquefasciatus was 14.24% in Panarung urban village, Aedes aegypti was 5.41% in Pahandut urban village. In Pahandut Seberang and Tumbang Rungan urban village were dominated by Aedes albopictus larvae (17.18% and 7.02% respectively). Most mosquito breeding habitats in ditches were 16.9% in Panarung urban villages. This reported the existence of mosquito breeding habitats in the environment which was significant to the abundance of mosquito larvae, and the observed conditions were thought to be the cause of the disease spread in Pahandut Sub-District.

1. Introduction

Palangka Raya City geographically is at 113° 30'-114° 07' East Longitude and 1° 35' - 2° 24' South Latitude. The total area of Palangka Raya City is 2,853.52 km², divided into five Sub-Districts, namely Sebangau, Jekan Raya, Pahandut, Bukit Batu, and Rakumpit. The city inhabited by 80,534 families. The largest population density has been found in Pahandut and Jekan Raya Districts [1]. Population density is related to the spread of diseases, including diseases carried by mosquitoes as vectors for several diseases endangering human life [2]. Mosquitoes transmit diseases such as dengue fever, malaria, japanese encephalitis, chikungunya, filariasis, and zika [3]. One of the causes of dengue fever increased every year because of the adult mosquito Aedes aegypti transmitted dengue fever transovarially [4].

The distribution of mosquitoes found in urban areas includes Aedes sp. and Culex sp. [5]. Mosquitoes found in urban environments were Aedes aegypti, Aedes albopictus, Culex quinquefasciatus [6]. Differences in geographical conditions of a place cause differences in environmental conditions between mosquito breeding sites [7]. In addition, the mosquito breeding habitats are typically found in indoors and outdoors [8].

Population growth in an area needs attention to the presence of mosquitoes in that area to prevent disease. Patients of dengue fever were hospitalized in 160 Hospitals of Palangka Raya City [9]. Thus, it
is pivotal to understand the life cycle of these mosquitoes to stop the spread of the disease. One of the reasons for the high emergence of dengue fever was thought due to inadequate attention to the presence of mosquito larvae in the environment. Research publication on the presence of mosquito larvae in Pahandut Sub-District limited or no information. This study aimed to navigate the presence of mosquito larvae as disease vectors in humans.

2. Methods
This study was a descriptive survey with a simple random sampling approach to determine the presence of mosquito larvae in the Pahandut Sub-District. The population of this study was disease vector mosquito larvae in Pahandut District, Palangka Raya City. The sample of this study was mosquito obtained in Pahandut Sub-District. This study was conducted from October to December 2019. Sampling of this study was in Pahandut District which was further administered to the Laboratory of the Faculty of Medicine, University of Palangka Raya. Mosquito larvae were collected in all urban villages environment of Pahandut Sub-District. Larvae found in environmental containers (mosquitoes breeding) was collected using a pipette for further identification in Biomedical Laboratory in Palangka Raya University. The identification of larvae was carried out using microscope and mosquito identification key book. Larvae containers were documented to determine the differences between containers. The results of data mosquito larvae were analyzed descriptively.

Figure 1. Map of study site in Pahandut Sub-District

3. Results and Discussion
The distribution of mosquito larvae was dominated by Cx. quinquefasciatus which was 20.89% in Langkai urban village, and 14.24% in Panarung urban village. The percentage of Ae. aegypti in Pahandut urban village was 5.41%. In the urban villages of Pahandut Seberang, and Tumbang Rungan were dominated by Ae. albopictus larvae, (17.18% and 7.02% respectively). The existence of Cx. quinquefasciatus larvae has been related to the availability of a mosquito habitat triggering the breeding in an environment near settlements or in ditches and swamps. Generally, these species are able to survive
in various environmental conditions [10]. Threshold temperature development and physiological time were estimated at *Cx. quinquefasciatus* was 10.96°C [11]. *Cx. quinquefasciatus* served as the main enzootic vector for West Nile Virus (WNV) [12]. *Cx. quinquefasciatus* was abundantly found in urban areas showed a positive correlation. Residential areas with high density have a risk of contracting WNV include visiting forests and swamps at night [13]. However, *Cx. quinquefasciatus* are not usually found in remote forest environments, but near to settlement part [14].

| Table 1. Distribution of mosquito larvae in Pahandut Sub-District |
|---|---|---|---|
| No | Urban village | Species | (n) | Percentage |
| 1 | Langkai | *Aedes aegypti* | 79 | 7.50 |
| 2 | Panarung | *Aedes aegypti* | 84 | 7.97 |
| 3 | Pahandut | *Aedes aegypti* | 57 | 5.41 |
| 4 | Tanjung Pinang | *Aedes aegypti* | 11 | 1.04 |
| 5 | Pahandut Seberang | *Aedes aegypti* | 24 | 2.27 |
| 6 | Tumbang Rungan | *Aedes aegypti* | 181 | 17.18 |
| | | *Aedes albopictus* | 74 | 7.02 |

*Characteristics of* *Cx. quinquefasciatus* *are typically described as:* antennae on a branched head, no thorns on the thorax, the size of the siphon is 1: 3 (ratio of width and length), with more than 1 pair of hair tuft on the siphon, pectin on the siphon without side spines, 3-4 the combteeth row at the last abdominal is the anal hairs. The characteristics of *Ae. aegypti* mosquito larvae have unbranched antennae with spines on the thorax. The size of the siphon is fat and short, with the combteeth at one row with side spines, added by a hair tuft on the siphon with the number of a pair. Their distinct parts also include caudal hairs, an anal brush, and a pectin-shaped gill on the siphon with side spines. The identified characteristics of *Culex vishni* larvae are antennae on a branching head with no spines on the thorax. The siphon is long and slender containing more than one pair of hair tufts without side spines on the siphon. There are three and four rows of combteeth on the last abdomen. In addition, other parts include anal gill, brush, and caudal hairs. Larvae of *Ae. albopictus* indicates round cylindrical head, short and soft antennae, and brush-shaped hairs on the front of the head. On the 7th abdominal segment, there is a distinctive, thornless comb tooth on the lateral part of the thorax (which distinguishes it from *Ae. aegypti*), measuring approximately 5 mm. The difference between instars of *Ae. albopictus* larvae are: instar I has a head width of 0.3 mm, instar II has a head width of 0.45 mm, instar III has a head width of 0.65 mm, and instar IV has a head width of 0.95 mm [15].

The most mosquito breeding places were thought in Langkai urban village compared to another urban village. The largest type of container was found in ditches (in Panarung compared to other urban villages) in Pahandut Sub-District. According to the DINKEs of Palangka Raya (2017), Pahandut Sub-District had the most DHF sufferers [9]. The dengue mosquito larvae species include *Ae. aegypti* and *Ae. albopictus*. In this study, *Ae. aegypti* was 7.50% in Langkai, and *Ae. albopictus* was 17.18% in Pahandut Seberang. The most percentage of *Cx. quinquefasciatus* larvae was 20.89% found in this Sub-District. The largest type of container was seven ditches compared to other containers in Langkai and Panarung villages. Ditches from the used tires were only five found in Pahandut urban village. The largest percentage of containers in the Pahandut Seberang and Pahandut villages was the used tires which were three and seven respectively. There were three containers of rubbers that were collected in Tumbang Rungan urban village.
### Table 2. Types of mosquito breeding containers

| Urban Village | Container Type   | Container + Larva Ae.aegypti | Container + Larva Ae.albopictus | Container + Larva Cx.quiquefasciatus | Container + Cx.vishnui |
|---------------|------------------|-------------------------------|---------------------------------|--------------------------------------|------------------------|
| Langkai       | Plastic cups     | 3.3                           | 0                               | 0                                    | 0                      |
|               | Used tires       | 5.1                           | 0                               | 0                                    | 0                      |
|               | Bucket           | 1.6                           | 0                               | 0                                    | 0                      |
|               | Puddle           | 1.6                           | 0                               | 0                                    | 0                      |
|               | Ditch            | 0                             | 0                               | 11.8                                 | 0                      |
|               | Fountain pot     | 0                             | 1.6                             | 0                                    | 0                      |
|               | Used tank air    | 1.6                           | 0                               | 0                                    | 0                      |
| Panarung       | Ditch            | 0                             | 0                               | 16.9                                 | 0                      |
|               | Used tires       | 0                             | 8.4                             | 0                                    | 0                      |
|               | Canal            | 0                             | 0                               | 1.6                                  | 0                      |
| Pahandut       | Used tires       | 6.7                           | 1.6                             | 0                                    | 0                      |
| Tanjung Pinang | Used tires       | 5.1                           | 0                               | 0                                    | 0                      |
|               | Boat             | 0                             | 1.6                             | 0                                    | 0                      |
|               | Plastic cups     | 0                             | 3.3                             | 0                                    | 0                      |
| Pahandut       | Used tires       | 0                             | 11.8                            | 0                                    | 0                      |
| Seberang       | Used pan         | 0                             | 0                               | 1.6                                  | 0                      |
|               | Used bucket      | 1.6                           | 0                               | 0                                    | 0                      |
|               | Swamp            | 0                             | 0                               | 0                                    | 1.6                    |
| Tumbang Rungan | Rubber container | 0                             | 5.1                             | 0                                    | 0                      |
|               | Used cans        | 0                             | 1.6                             | 0                                    | 0                      |
|               | Kettle           | 0                             | 1.6                             | 0                                    | 0                      |
|               | Plastic cups     | 0                             | 1.6                             | 0                                    | 0                      |

**Figure 2.** Container types in Pahandut Sub-District: (a) used tires, (b) ditch, (c) puddle, (d) boat, (e) rubber container, (f) swamp, (g) plastic cups, (h) used pan

Mosquitoes have diverse habitats enabling this species to colonize in many types of environments. The immature stages of mosquitoes are typically found in various habitats, including used tires, on the surface of floating plants, along margins of water pools and streams, on the walls of artificial containers,
or in moist habitat subject due to flooding [16,17]. This finding was in accordance with previous study (Alkhayat et al., 2020) indicating 20% of breeding places were on ditches [18]. Another relevant study (Mathania et al., 2020) also asserted that 23.3% of breeding places were found in ditches during the rainy season and dry season [19]. Boukraa et al. (2016) also reported significant amount (n = 723) of Culex. sp were in ditches [20].

4. Conclusion
The largest distribution of mosquito larvae was dominated by Cx. quinquefasciatus in Pahandut sub-district. The largest type of container was ditch in Panarung urban village. This study reported that the existence of mosquito breeding places in environment served as significant pathway to navigate the abundant presence of mosquito larvae, and the observed conditions provided the information to navigate the cause of the disease spread in Pahandut Sub-District.

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