EARLY DETECTION OF MALARIA VECTORS THROUGH THE DIVERSITY OF ANOPHELES

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EARLY DETECTION OF MALARIA VECTORS THROUGH THE DIVERSITY OF ANOPHELES Sp

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ABSTRACT

Malaria is an infectious disease which gets serious attention throughout the world. Malaria is caused by a protozoan parasite infection – a genus of plasmodium which lives and breeds in infected human red blood cells. Ogan Komering Ulu District has a tropical and wet climate with temperatures varying between 22-31 celcius degree. These temperature conditions support the Anopheles mosquitoes breeding that have optimum development 20-30°C. The characteristics of the Anopheles mosquitoes can transmit malaria, they have black, short and small body, with the same length between proboscis and pupae. The aim of this research was to identify the morphology that can be useful to know the characters and total number of species so that it can describe the Anopheles diversity in an area. This research was conducted in December 2017 to March 2018. Based on the research that has been done, there are seven types of malaria vector found during this research, they are *Anopheles barbirostris, Anopheles kochi, Anopheles maculatus, Anopheles nigerrimus*, *Anopheles subpictus, Anopheles tesselatus* and *Anopheles vagus.* The results of calculation of MHD, MBR, Relational Abundance, number frequency and dominance of figures showing that the mosquito *Anopheles vagus* has the highest percentage value of the vagus 9.97, 9.97, 88.05, 0.880, and 77.484. As for the mosquito *Anopheles maculatus* and *Anopheles subpictus* has the same and lowest percentage values of 0.02, 0.02, 0.18, 0.001, and 0.00018, which indicates that doubled in two different months, the mosquito Anopheles vagus has potenis most high as vectors of malaria. Anopheles vagus dominated his existence an hour catching up so that it is known that malaria vectors has a wide range of activities.

Keywords: *Anopheles sp, parasite infection, malaria vectors, diversity*

BACKGROUND

Malaria is an infectious disease caused by plasmodium which is transmitted through the bite of the Anopheles mosquito, a disease that threatens humanity, especially those who live in the tropics and sub-tropics. The transmission of malaria vector disease is influenced by many factors. According to Bustam et al., (2012), one of the factors that have been known to have an association with malaria is regional topography that is closely related to the pattern of transmission.

The topography and the altitude of Ogan komering Ulu Regency range from 0–1.000 meters above the sea level. This is understandable because Ogan Komering Ulu Regency is located on the lane of Bukit Barisan in the southern region. It has a tropical and wet climates with temperatures vary between 22-31°C. This temperature condition supports the breeding of the Anopheles mosquito which has an optimum development of 20-30°C thus increase the potential for malaria to occur in this area (Taviv et al., 2015).

Anopheles sp. is spread from unequal geographic regions which indicate specific local differences. This can occur because the typical geographical conditions can cause the changes in the nature of life and adaptation of Anopheles spp. in that area. Therefore, the efforts to control malaria vectors must be carried out in accordance with the biological and bionomic characteristics of Anopheles sp. which is found in that area. Vector control can be optimized if it is based on local entomological data, especially those which are related to the Anopheles spp. and behavior (Rahmawati et al., 2014).

Mosquitoes breed normally at the optimum temperatures (25°C-27°C). According to Ernamaiyanti (2010), low temperatures will inhibit the growth of larva, while high temperatures will kill the larva. The presence of other plants can affect the life of the larvae because it can block sunlight or protect the larvae from the attack of other living things.

The aim of this research was to identify the morphology that can be useful to know the characters and total number of species so that it can describe the Anopheles diversity in an area.

SUBJECT AND METHODS

Time and Place

This research was conducted in December 2017 to March 2018. It was located in Kemelak Bindung Langit Village, Ogan Komering Ulu Regency, South Sumatra. The location of the study was determined based on several criteria, such as the variety of Anopheles sp. which has more than two species and the existence of Anopheles sp breeding sites in more than two places. The implementation steps were: field sampling, then identification and data analysis in the laboratory. Mosquitoes are captured using an aspirator mosquitoes were captured using an aspirator and identified using a dissecting microscope and identification key.

Catching Malaria Mosquito Vector

Catching the adult mosquitoes was done for two nights in different months, February and March. Four houses were chosen with the criteria that there were some residents who positively have parasites, or close to the potential habitat of Anopheles spp. There were 4 collectors, and each house only had one collector. The catching process started from 18:00 - 06:00 WIB and was carried out in every hour with 40 minutes of catching time with human landing collection method, and 10 minutes with resting collection method. The mosquitoes were collected by using human landing collection method and resting collection method.

Identification of *Anopheles* sp

The identification of Anopheles mosquitoes was conducted by the researchers and was assisted by the experts of P2B2 Research Institute Baturaja. The identification was undertaken to get the mosquitoes of the Anopheles genus and its species. It was conducted by using a stereo microscope where the characteristics found in the mosquito were matched with a key with an adult Anopheles available so that the genus and its species were known. Data on the number of Anopheles obtained per species were then recorded into the observation sheet. Data analysis in research on the diversity of Anopheles species includes:

1. *Man Density per Hour* (MDH)

$$MHD = \frac{JN}{0 \times H}$$

Information :

MHD = *Man Hour Density*

JN = Total Number of Each Species

H = Total Number of Catching Hours

O = Total Number of Collector

2. *Man Bite Rate* (MBR)

$$MBR = \frac{JN}{0 \times H}$$

Information :

MHD = *Man Hour Density*

JN = Total Number of Each Species

H = Total Number of Catching Hours

O = Total Number of Collector

3. Nisbi Abundance

$$\text{Nisbi abudance} = \frac{\text{number of species that cacthed}}{\text{Total of species that cacthed}} \times 100\%$$

4. Frequency Number

$$\text{Fequency} = \frac{\text{number of species that cacthed}}{\text{total of species that cacthed}}$$

5. Domination Number

Domination Number = relative abundance x frequency number

RESULTS

The result of the two months research showed that the type of Anopheles in Kemelak Bindung Langit Village, found by using resting collection and human landing collection, consisted of seven species, they are *An.kochi, An. tesselatus, An. nigerrimus, An. vagus, An. barbirostris, An. subpictus dan An. Maculatus* (Figure 1).

This research showed about vvarieties of Anopheles sp. which were cachted in February (Table 1) and March (Tabel 3) 2018 in Kelurahan Kemelak Bindung Langit; value of MHD, MBR, *Kelimpahan Nisbi,* Frequency and Domination number of Malaria Vector that Cacth in February (Table 2) and March (Table 4) 2018 in Kelurahan Kemelak Bindung Langit; and association of Temperature and Humidity to Varietis and Number of Malaria Vector that Cacthed in Kelurahan Kemelak Bindung Langit on Februari and March (Table 5); and last, showed about fluctuation of Malaria Vector Density that Cacthed per Hour during Cacthing in Desa Kemelak Bindung Langit.

DISCUSSION

An. kochi's abdomen has prominent fur like buttons, this characteristic is only possessed by the *An.vagus* mosquito and is not found in other Anopheles mosquito species. Some fluctuations occur irregularly during the blood sucking activity of An. Kochi. According to Boewono and Ristiyanto (2005), *An. kochi* starts sucking blood from 23: 00-06: 00 WIB, with peak activity occurs at 00:00–01:00 WIB outside the house. *Anopheles kochi* shows an esophagi tendency.

An. tesselatus has at least 4 pale bracelets found on the pupae. According to Santoso (2013), *An. tesselatus* has second to seventh abdominal sternest with no brushes consisting of dark scales. *An. nigerrimus* is a type of mosquito that has prepical veins without scales or pale bracelet on medium back tarsis. According to Riski *et al.*, (2015), the pale bracelet on sections 3-4 has the same length or less than segment 5. While the hind legs is totally dark, with a distance from the colored portion of the proboscis ¾ the size of the black color. *An. vagus* has a proboscis length approximately equal to the length of the palpi. According to Zavortink (1964), the pale bracelet at the end of the palpi is at least

3 times the length of the dark part of the palpi below it. Observations show that *An. Vagus* mosquito has 4 or more pale wing's veins.

The morphology of *An. barbirostris* has the same proboscis features as palpi and all parts are dark. Palpi without pale bracelets. Munchid *et al.*, (2015), ribs and the 1stwing vein have 3 or less pale stains. The 5thtarsus of the hind legs is mostly dark. *An. subpictus* has a proboscis about the same length as palpi and all its parts are dark colored. There is a pale bracelet at the end of the palpi which is 2 times or less than the length of the dark part below. According to Dharmawan *et al.*, (2005), *An. maculatus* 5thtarsus of the hind legs is partially or completely has a pale bracelet at the end of the palpi (apical and subapical) width. According to Budi *et al.*, (2014), there is no pale bracelet between the tarsus tibia of the hind legs. Femur and tibia have spots and pale spots. At least the 5th tarsus of the hind legs is white.

During the study, the number of *Anopheles* mosquitoes caught on each catching was very fluctuating. Based on the results of the catching method, it was found out that *Anopheles* was mostly caught by using human body as bait outside of the home. This is in line with the research of Lestari *et al.*, (2007), which states that *Anopheles* mosquitoes in the village of Lifuleo suck more human blood outside of the home (esophagi).

Anopheles mosquitoes that were caught in the village of Kemelak in February and March showed varying fluctuations in each species during 2 catching periods. Rainfall conditions in the village were inversely proportional to the density of *Anopheles*, for example if rainfall intensity was high then the density of Anopheles decreases, whereas if rainfall intensity was low, the density of *Anopheles* increases (Figure 1). This result is different from the results of Rahmawati *et al.* (2014), which stated that rainfall conditions in the village of Lifuleo were directly proportional to the density of *Anopheles*, if rainfall had high intensity then the density of *Anopheles* also increases. *Anopheles* density tends to be high. This is caused by regional conditions. The village of Kemelak Bindung Langit is a mountainous area with a higher rainfall index so that it has a type of habitat in which high intensity rainfall can reduce the mosquito population and even eliminate breeding habitats.

In general, seven species which were caught in February showed low density and subsequently increased in March. This is in line with the results of a study by Shinta *et al*. (2013), which states that mosquito density was influenced by rainfall and availability of breeding sites at the research site. Based on the research obtained, the types of *Anopheles* mosquito in this area has good adaptation to temperature and humidity, especially *An. vagus* which has the most density during catching process took place compared to *An. barbirostris* and *An. kochi*. This is in accordance with the research conducted by Mading (2013), where temperature and air humidity greatly affect the density and number of *Anopheles* mosquitoes. Temperatures of 24-30°C and 60% air humidity were found to be optimum for the breeding of *Anopheles* mosquitoes, especially the species of *An. vagus* mosquitoes.

The differences in mosquito density at each catching hour were influenced by the level temperatures and humidity that can be seen in Table 4.5.1 and Figure 1. During the study, the surrounding temperature at night was between 20 °C and 29 °C and humidity between 60% and 70%. This level of humidity allows *Anopheles* mosquitoes to live and breed well so that this area is vulnerable to an increase in *Anopheles* population. According to Munif *et al.*, (2008), the lowest humidity that allows mosquitoes to live is 60%. Humidity that is below 60% will shorten the life of the mosquito, thereby reducing its density. The highest temperature occurred at 19:00-20:00 and lowest at 24:00-01:00. At temperatures above 29 °C the average density of *Anopheles* decreased and the peak density could occur at temperatures of 22 °C to 27 ° .The lowest humidity occurred at 10:00–06:00 and the highest at 21:00–22:00.

According to Kazwaini & Mading (2014), larvae density becomes an indicator of conducive or non-conducive habitat for Anopheles sp. Water level and movement of water in the habitat can cause larvae to spread above the surface. This may cause low larvae density, while high larvae density has an increase in Anopheles population. An increase in the number of mosquito populations will increase the transmission of malaria in the region. The research of Mandasari (2012) shown uncertain weather conditions have a positive and negative impact on the survival of Anopheles larvae. Changes in temperature and rainfall can cause mosquitoes to lay eggs more often and vector populations.

CONCLUSION

Based on the results of the study it can be concluded:

1. There are 7 Anopheles species in the observation area : *An. barbirostris, An. kochi, An. maculatus, An. nigerrimus, An. subpictus, An. tesselatus* and *An. vagus*.
2. MHD, MBR, nisbi abundance, frequency and domination were highest found on *An. vagus* with a value of 9.97, 9.97, 88.05%, 0.880, and 77.484, while the lowest value was found on *An. maculatus* and *An. subpictus* with values of 0.02, 0.02, 0.18%, 0.001 and 0, 00018
3. During two arrests in two different months, *An. vagus* has the highest potential as a malaria vector with the best adaptability and various activities.

ACKNOWLEDGEMENT

The acknowledgement is given to student in Biology Department of Mathematics and Natural Sciences Faculty who have helped in collecting data until the research was completed.

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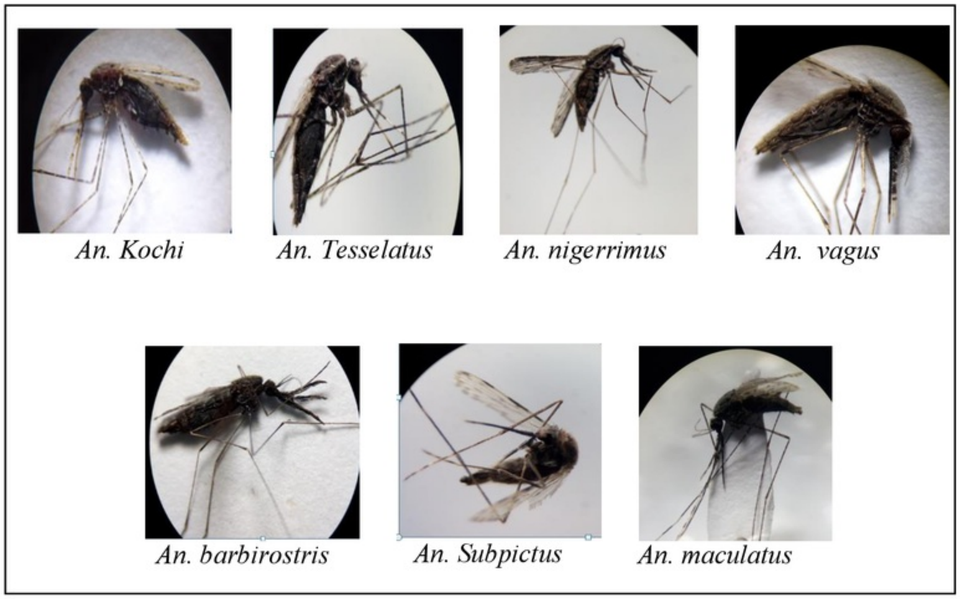

Figure 1.

Varieties of Anopheles spp. which were cachted in February 2018 in Kelurahan Kemelak Bindung Langit

Table 1. Varieties of Anopheles sp. which were cachted in February 2018 in Kelurahan Kemelak Bindung Langit

No	Mosquitos Species	Cacthing Method				Total
		Human Bait		Resting		
		Indoor (UOD)	Outdoor (UOL)	Indoor (RD)	Outdoor (RL)	
1	Anopheles barbirostris	1	0	0	0	1
2	Anopheles kochi	0	1	0	0	1
3	Anopheles vagus	0	0	0	16	16
Total		1	1	0	16	18

Table 2. Value of MHD, MBR, *Kelimpahan Nisbi,* Frequency and Domination number of Malaria Vector that Cacth in February 2018 in Kelurahan Kemelak Bindung Langit

No	Mosquitos Species	MHD	MBR	*Kelimpahan Nisbi*	Frequency	Dominant number
1	Anopheles barbirostris	0.02	0.02	5.5%	0.055	0.3025
2	Anopheles kochi	0.02	0.02	5.5%	0.055	0.3025
3	Anopheles vagus	0.33	0.33	89%	0.89	79.21

Table 3. Varieties of Anopheles sp. which were Cachted with Various Method in March 2018 in Kelurahan Kemelak Bindung Langit

No	Mosquitos Species	Cacthing Method				Total
		Human Bait		Resting		
		Indoor (UOD)	Outdoor (UOL)	Indoor (RD)	Outdoor (RL)	
1	Anopheles barbirostris	2	7	1	3	13
2	Anopheles kochi	4	1	1	2	8
3	Anopheles maculatus	1	0	0	0	1
4	Anopheles nigerrimus	7	0	11	13	31
5	Anopheles subpictus	0	0	1	0	1
6	Anopheles tesselatus	5	0	4	2	11
7	Anopheles vagus	122	55	124	178	479
Total		141	63	142	198	544

Table 4. Value of MHD, MBR, *Kelimpahan Nisbi,* Frequency and Domination number of Malaria Vector that Cacth in March 2018 in Kelurahan Kemelak Bindung Langit

No	Mosquitos Species	MHD	MBR	*Kelimpahan Nisbi*	Frequency	Dominant number
1	Anopheles barbirostris	0.27	0.27	2.38%	0.023	0.054
2	Anopheles kochi	0.16	0.16	1.47%	0.014	0.020
3	Anopheles maculatus	0.02	0.02	0.18%	0.001	0.00018
4	Anopheles nigerrimus	0.64	0.64	5.69%	0.056	0.318
5	Anopheles subpictus	0.02	0.02	0.18%	0.001	0.00018
6	Anopheles tesselatus	0.22	0.22	2.02%	0.020	0.040
7	Anopheles vagus	9.97	9.97	88.05%	0.880	77.484

Table 5. Association of Temperature and Humidity to Varietis and Number of Malaria Vector that Cacthed in Kelurahan Kemelak Bindung Langit on Februari and March

Time	Min. Temperature (°C)	Maks. Temperature (°C)	Humidity (%RH)
18.00-19.00	26	30	62
19.00-20.00	29	30	62
20.00-21.00	29	29	60
21.00-22.00	27	30	70
22.00-23.00	21	29	60
23.00-00.00	22	29	60
00.00-01.00	20	29	60
01.00-02.00	25	35	60
02.00-03.00	25	29	60
03.00-04.00	25	29	60
04.00-05.00	25	29	60
05.00-06.00	22	29	60

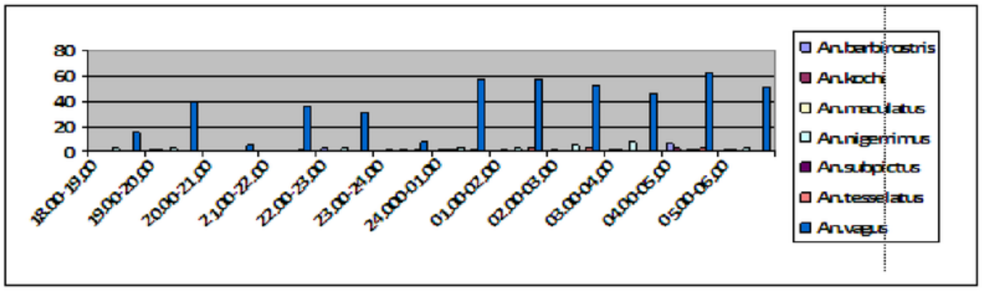

Figure 2.
Fluctuation of Malaria Vector Density that Cacthed per Hour during Cacthing in Desa Kemelak Bindung Langit

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