Identification of *Anopheles sp.* at Cibenda Urban Village Parigi Sub-District Pangandaran District

A Nurmalasari¹*, U Ruhimat¹, D Setiawan¹, F Y Pradani², A Farihatun¹, N D Susilowati¹, R A Sunaryo¹, H Tussoliah¹

¹STIKes Muhammadiyah Ciamis, West Java, Indonesia
²Loka Litbangkes Pangandaran, Kementrian Kesehatan Republik Indonesia, West Java, Indonesia

*arynurmalasari@stikesmucis.ac.id

**Abstract.** Malaria is an endemic parasitic disease that attacks countries with dense populations, which can reappear according to changes in natural phenomena, for example following environmental changes related to the growth of *Anopheles sp.* *Anopheles sp.* mosquitoes act as malaria vectors in the Southeast Asia region. Identification of *Anopheles sp.* species is an important step to recognize the characteristics of various types of *Anopheles sp.* mosquitoes. Cibenda Village is located in the lowlands and borders the coast to be the mouth of the river and the waters of the Indonesian Ocean which allows the *Anopheles sp.* breeding. This study aims to determine the presence of *Anopheles sp.* in Cibenda Urban Village Parigi Sub District Pangandaran District as a risk factor for malaria transmission. This research is a descriptive research. The data obtained is presented in the form of tables and narratives. The examination method used is a microscopic method. The conclusions of this study are founded *Anopheles sundaicus*, *Anopheles barbirostris*, *Anopheles subpictus*, *Anopheles vagus* in Cibenda Urban Village Parigi Sub District Pangandaran District which have potential as risk factors for malaria transmission.

1. Introduction

Malaria is an endemic parasitic disease that attacks densely populated countries. In Indonesia there are 15 million cases of malaria per year, 30,000 of them die, 35% of the population is at risk of malaria (Irianto, 2013). *Anopheles mosquit o* is one of the vector (transmitters) of malaria.[1] Overall, the known *Anopheles sp* mosquitoes number 424 species of which 70 species have been proven to be malaria vectors.[1] The number of species that become malaria vectors is increasing with the discovery of new species through bionomic identification and research activities.[2] *Anopheles mosquitoes* that act as malaria vectors in Southeast Asia, in general, are cryptic species (sibling species/isomorphic species) which is inserted into the taxon of complex species. Members of complex species have morphologies that are similar to each other so often false identify. The characteristics and bionomics of each species are different, therefore it can have a direct effect on epidemiology and control.

The character and bionomic differences consist of vectorial capacity, resistance to insecticides, host preferences for blood sources, periodicity and resting places.[2] The identification of the *Anopheles*
mosquito species is a very important step to get to know the characteristics possessed by various types of Anopheles mosquitoes.[2]

Pangandaran is the youngest district in the province of West Java, Desa Cibenda which is in the lowlands and borders the coast which is the mouth of the river and the waters of the Indonesian Ocean allow Anoph eles sp to breed. Desa Cibenda also has brackish waters that are suitable for the development of several mosquito species from the genus Anopheles.[3]

Malaria is a disease that can re-emerge according to changes in natural phenomena, for example following environmental changes related to the development of Anopheles sp mosquitoes and population mobilization. Therefore, even though malaria is experiencing a downward trend or even in some regions it has disappeared. But in the future it is very likely to be able to increase again and even become an outbreak, because of the risk factors for transmission. The most dominant factor is the presence of vectors, namely Anopheles sp mosquitoes that are closely related to ecosystem and climate changes, and parasites as a source of transmission.[4]

2. Research Objectives
This study aims to determine the presence of Anopheles sp. in Cibenda Urban Village Parigi Sub District Pangandaran District.

3. Population and Sample
3.1. Population
The population used in this study were all mosquitoes caught in the study period at Cibenda Urban Village Parigi Sub District Pangandaran District.

3.2. Sample
The sample used in this study is the entire population at Cibenda Urban Village Parigi Sub District Pangandaran District. Sample were taken using incidental sampling techniques where researchers used makeshift samples at the time of the study.

4. Methods
4.1. Research Methods
The research method used is descriptive with cross sectional research design. This research was conducted in February and June 2018.

4.2. Data Collection Technique
The data collection method used in this study is the observation method. In this method the data used are primary data resulting from the identification of Anopheles sp. mosquitoes at Cibenda Urban Village Parigi Sub District Pangandaran District.

4.3. Materials
4.3.1. Tools
Tools used in research are Aspirator, Paper cup, Flashlight, Stereo Microscope, Pinset, Petri dish, Weather station, Pinning set.

4.3.2. Materials
Materials used in this research are Chloroform, Cotton, Paperpoint, Gauze and Rubber bracelet.

4.4. Research Procedure
The location of catching mosquitoes does not have specific criteria. However, it is preferred that houses with lots of plants nearby and close to ponds are abandoned, or it could be in homes adjacent to the Anopheles sp mosquito breeding sites (such as mountains, beaches, lagoon and marshes) with a maximum distance of 500 meters.[1]

Catching mosquitoes used an aspirator
Umpan Orang Dalam (UOD) for in-house capture and Umpan Orang Luar (UOL) for arrests carried out outside the house as well as Umpan Kandang Ternak (UKT) for fishing near cattle sheds. The
arrest is carried out every 50 minutes in 1 hour, 40 minutes of arrest when the mosquitoes land on the human body (human landing collection) and 10 minutes when the mosquito lands on the wall or resting collection and 10 minutes to rest. Arrests were carried out for 12 hours starting at 6:00 p.m. WIB until 6:00 a.m. in the morning at a resident's house. The arrests were carried out by collectors of 4 people, 2 people made arrests inside the house, 2 people made arrests outside the house and each made arrests at 2 different houses and jointly carried out arrests around the enclosure. While 1 person identifies alternately. Collectors sit inside and outside the house where residents live at night. Light up the place where mosquitoes usually get by using a flashlight. Mosquitoes that perch on the human body, then captured by suctioning using aspirators.[5] The catches of mosquitoes are then inserted into the paper cup every hour and collected according to the hours of arrest.[6] Then the mosquitoes are turned off using cotton that has been given 70% chloroform.

Pinning
After death, the mosquito is pinned using pinning needles and point paper. Cut paper points using point punch molds to form triangles. Insert the pinning needle on the blunt part of the paper point, adjust the height on the needle. In the pointed part, the paper point is given an adhesive (clear nail polish) to glue the mosquito. Next place the mosquito in a slanted position, the thorax attaches to the point of the pointed paper. Adjust the position of the mosquito so that the legs and thorax are facing the researcher. After that label it (number, date of arrest, location, method, species, name of collector) in the mosquito by sticking it under the paper point.

Identification
Identification of adult mosquitoes was observed for wing morphology, hind limbs, probosis and maxillary palpi by using a reference book Key to Anopheles Mosquito Adults in Indonesia and then specifying the Anopheles species. Data from the identification results were recorded and then the confirmed data related to the mosquito species caught were then processed according to the results of identification of the Anopheles mosquito.

5. Result
The results of research conducted at Cibenda Urban Village Parigi Sub District Pangandaran District., caught several species of mosquitoes. The results of the first and second mosquitoes can be seen in the table below:

Table 1. Results Caught of Mosquitoes in Cibenda Urban Village Parigi Sub District Pangandaran District on February 19, 2018

| No | Species                  | Methode | Nominal |
|----|--------------------------|---------|---------|
|    |                          | UOD     | DD      | UOL    | KD    |     |
| 1  | Anopheles barbirostris   | -       | -       | 1      | -     | 1    |
| 2  | Anopheles subpictus      | -       | -       | -      | 1     | 1    |
| 3  | Anopheles sundaicus      | -       | -       | -      | 1     | 1    |
| 4  | Anopheles vagus          | -       | -       | -      | 3     | 3    |
| 5  | Armigeres kesseli        | -       | 1       | -      | -     | 1    |
| 6  | Armigeres kuchingensis   | -       | -       | 1      | 4     | 5    |
| 7  | Armigeres malayi         | -       | -       | -      | 2     | 2    |
| 8  | Armigeres theobaldi      | -       | -       | -      | 1     | 1    |
| 9  | Culex bitaeniorhynchus   | -       | -       | 1      | -     | 1    |
| 10 | Culex gellidus           | -       | -       | -      | 3     | 3    |
| 11 | Culex sitiens            | 2       | -       | 1      | -     | 3    |
| 12 | Culex quinquefasciatus   | -       | -       | 1      | -     | 1    |
| 13 | Culex vishni             | -       | -       | 10     | 2     | 12   |
|    | Total                    | 2       | 1       | 15     | 17    | 35   |
Table 2. Results Caught of Mosquitoes in Cibenda Urban Village Parigi Sub District Pangandaran District on June 21, 2018

| No | Species                | Method | Nominal |
|----|------------------------|--------|---------|
| 1  | Aedes albopictus       | UOD    | 1       |
| 2  | Aedes polistilus       | DD     | 2       |
| 3  | Anopheles vagus        | UOL    | 22      |
| 4  | Anopheles sundaicus    | KD     | 21      |
| 5  | Armigeres kesseli      |        | 1       |
| 6  | Armigeres kuchingensis |        | 1       |
| 7  | Armigeres malayi       |        | 2       |
| 8  | Culex vishnui          |        | 25      |
| 9  | Culex quinquefasciatus |        | 46      |
|    | Total                  |        | 73      |

Keterangan:
- UOD: Inside People Bait
- UOL: Outside People Bait
- DD: Wall inside the house
- KD: Around the Livestock Cage

The first collect on February 19, 2018, was obtained by 6 Anopheles sp. mosquitoes. The most is An. vagus. While the second collect on June 21, 2018, caught mosquitoes were dominated by 48 Anopheles sp mosquitoes, then Culex sp. Mosquitoes as many as 47 tails, Aedes sp as many as 5 and Armigeres sp as many as 4 tails. In the first and second collect, the dominating species were Culex vishnui.

The existence of mosquitoes in a place can be influenced by several factors, including rainfall, temperature, humidity and wind speed. The following are the environmental conditions at the time of collect:

Table 3. Environmental Conditions during Collect on February 19, 2018

| No  | Time    | Temperature (°C) | Humidity (%RH) | Velocity (km/hour) | Rainfall (mm) | Air Pressure |
|-----|---------|------------------|----------------|--------------------|---------------|--------------|
|     | In      | Out              | In             | Out                |               |              |
| 1   | 18.00-19.00 | 28.6  | 27.0   | 79     | 84     | 0.0  | 0.0  | 1007.0 |
| 2   | 19.00-20.00 | 28.5  | 26.4   | 81     | 86     | 0.0  | 0.0  | 1008.5 |
| 3   | 20.00-21.00 | 28.3  | 25.6   | 83     | 95     | 0.0  | 1.8  | 1009.5 |
| 4   | 21.00-22.00 | 27.9  | 25.1   | 82     | 97     | 0.0  | 4.8  | 1009.6 |
| 5   | 22.00-23.00 | 27.1  | 24.8   | 83     | 99     | 0.0  | 1.8  | 1009.2 |
| 6   | 23.00-24.00 | 26.6  | 24.4   | 85     | 99     | 0.0  | 0.0  | 1007.9 |
| 7   | 00.00-01.00 | 26.7  | 24.3   | 85     | 99     | 0.0  | 0.0  | 1007.4 |
| 8   | 01.00-02.00 | 25.8  | 24.2   | 86     | 99     | 0.0  | 0.0  | 1007.3 |
| 9   | 02.00-03.00 | 25.8  | 24.0   | 86     | 99     | 0.0  | 0.0  | 1007.5 |
| 10  | 03.00-04.00 | 25.8  | 24.0   | 87     | 99     | 0.0  | 0.0  | 1007.7 |
| 11  | 04.00-05.00 | 25.8  | 23.9   | 87     | 99     | 0.0  | 0.0  | 1007.9 |
| 12  | 05.00-06.00 | 25.6  | 23.7   | 87     | 99     | 0.0  | 0.0  | 1008.4 |

Based on table 3, the intensity of rainfall at 21.00-22.00 WIB is quite high at 4.8 mm so that at that time mosquitoes were found to be small, because high rainfall will increase humidity. [7]
| No | Time         | Temperature (°C) | Humidity (%RH) | Velocity (km/hour) | Rainfall (mm) | Air Pressure |
|----|--------------|------------------|----------------|-------------------|---------------|--------------|
|    |              | In               | Out            | In                | Out           |              |
| 1  | 18.00-19.00  | 29.5             | 26.9           | 78                | 87            | 2.5          |
| 2  | 19.00-20.00  | 29.3             | 26.7           | 78                | 85            | 2.3          |
| 3  | 20.00-21.00  | 29.1             | 26.7           | 79                | 86            | 1.1          |
| 4  | 21.00-22.00  | 29.1             | 26.9           | 79                | 85            | 1.1          |
| 5  | 22.00-23.00  | 29.0             | 27.0           | 79                | 86            | 1.1          |
| 6  | 23.00-24.00  | 28.9             | 27.0           | 80                | 85            | 2.5          |
| 7  | 00.00-01.00  | 28.9             | 27.0           | 80                | 87            | 0.0          |
| 8  | 01.00-02.00  | 28.8             | 25.8           | 80                | 98            | 2.5          |
| 9  | 02.00-03.00  | 28.6             | 26.5           | 80                | 87            | 2.5          |
| 10 | 03.00-04.00  | 28.4             | 26.5           | 80                | 87            | 3.6          |
| 11 | 04.00-05.00  | 28.2             | 26.6           | 80                | 83            | 1.1          |
| 12 | 05.00-06.00  | 28.2             | 26.7           | 80                | 84            | 3.6          |

Based on table 4, the highest rainfall is at 01.00-02.00 WIB which is 1.5 mm. So that at that time the mosquitoes caught were relatively fewer.

6. Discussion

Based on the results of the study between the first and second arrests, the second was found in *Anopheles sundaicus*. The arrest was carried out for 12 hours and in conditions of rain that caused the number of mosquitoes caught a little. The possibility of this happens because there are several factors that can affect the presence of mosquitoes, including rainfall, temperature, humidity and wind speed. This was supported by the study of Muhammad (2013) in Fahmi, Fahri, Nurwidayati and Suwastika (2014), which stated that arrests carried out in conditions of rain at night resulted in fewer mosquitoes being caught. Temperature and humidity also affect the density of mosquitoes somewhere. Rainfall will affect humidity, i.e., humidity will increase when rainfall increases. At the time of the first arrest, the highest rainfall was 4.8 mm at 21.00-22.00 WIB with outdoor humidity 97% RH, while on the second arrest, the highest rainfall was 1.5 mm at 01.00-02.00 WIB with outdoor humidity 98% RH. Therefore at the time of the arrest, fewer mosquitoes were caught. This is because the humidity conducive to mosquitoes is 60-80% RH.[8]

In addition to rainfall, temperature can also affect the presence of *Anopheles sp.* mosquitoes. The optimum temperature ranges from 25-27°C for mosquito breeding. During the first arrest in February 2018, the outdoor temperature averaged less than 25°C, while in the second collect in June 2018, the average temperature ranged from 26-27°C this allows mosquitoes to breed.[5]

7. Conclusion

*Anopheles sp.* mosquito (*Anopheles sundaicus, Anopheles barbirostris, Anopheles subpictus, Anopheles vagus*) was found in Desa Cibenda Kecamatan Parigi Kabupaten Pangandaran which can act as a malaria transmission vector.

8. References

[1] et al Prasetyowati, “Fauna Anopheles,” *Heal. advocacy*, 2013.
[2] Nuryady and M. Moh, “Identifikasi Morfologi Spesies Vektor Malaria di B2P2VRP Salatiga,” 2013.
[3] K. Ulfah and A. Widayanto, “Deskripsi Bionomik Nyamuk Anopheles sp di Wilayah Kecamatan Parigi Kabupaten Pangandaran,” Keslingmas, vol. 35, pp. 278–396, 2016.
[4] L. HAkim, “Faktor Resiko Penularan Malaria di Desa Pamotan Kabupaten Pangandaran,” Aspirator, vol. 5, no. 2, pp. 45–54, 2013.
[5] R. Kemenkes, Modul Entomologi Malaria. Jakarta, 2013.
[6] Kazwaini, M. Willa, and Ruben Wadu, “Korelasi Kepadatan Anopheles spp dengan Curah Hujan serta Status Vektor Malaria pada Berbagai tipe Geografi di Kabupaten Sumba Timur,” Bul. Penelit. Kesehat., vol. 43, no. 2, pp. 77–88, 2015.
[7] S. Sulasmi, Setyanungtyas, D. Eka, Akmad, Rahayu, and Nita, “Pengaruh Curah Hujan, Kelembabab, dan Temperatur terhadap Prevalensi MAlaria di Kabupaten Tanah BAmbu KAlimantan Selatan,” J. Epidemiol. Commun. Disesses, vol. 3, no. 1, pp. 22–27, 2017.
[8] Zebua, S. Berlian, Naria, Evi, Marsaulina, and Irnawati, “Hubungan Kondisi Kandang Ternak dengan Kejadian Malaria pada Masyarakat di Desa Lawu Kecamatan Gido Kabupaten Nias,” 2013.

Acknowledgments
Thank you to STIKes Muhammadiyah Ciamis and Litbangkes Kemenkes RI Pangandaran District.