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# CHARACTERISTICS OF ANOPHELES BREEDING PLACES IN DAHIAN TAMBUK VILLAGE, GUNUNG MAS DISTRICT, CENTRAL KALIMANTAN

## *KARAKTERISTIK TEMPAT PERINDUKAN LARVA ANOPHELES DI DESA DAHIAN TAMBUK KABUPATEN GUNUNG MAS, PROVINSI KALIMANTAN TENGAH, INDONESIA*

**Original Research Article**
*Penelitian*

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**A B S T R A C T**

***Background:*** *Malaria cases in Dahian Tambuk Village have been ranked first for four consecutive years in Gunung Mas District.* ***Purpose:*** *This study aims to describe the physical and chemical characteristics of Anopheles breeding places in Dahian Tambuk Village, Gunung Mas District.* ***Method:*** *It is a descriptive study using a survey method. The characteristics studied were Anopheles species, number, temperature, salinity, breeding sites, and density of larvae found in each breeding site.* ***Result:*** *Seven breeding places were found positive to contain Anopheles larvae, consisting of puddles, fish ponds, and sewers. The sewer was predominantly found. Physical characteristics of water showed a temperature ranging from 29.9 $^0$C - 35 $^0$C, pH levels between 5.35 - 6, and a salinity of 0 ppt, with a density level of 9 larvae/2 dippers. The species of Anopheles larvae found in all breeding sites was identified as Anopheles kochi.* ***Conclusion:*** *Seven breeding sites found in the studied area consisted of puddles, fish ponds, and sewers, with physical characteristics that qualify for Anopheles larvae in general An. kochi was the only species of larvae found in all breeding sites.*

**A R T I C L E  I N F O**

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**A B S T R A K**

**Latar belakang:** Kasus malaria di Desa Dahian Tambuk selama empat tahun berturut-turut menduduki peringkat pertama di kabupaten Gunung Mas. **Tujuan:** Penelitian ini bertujuan untuk mendeskripsikan karakteristik fisik dan kimia dari tempat perindukan larva di Desa Dahian Tambuk, Kabupaten Gunung Mas, Provinsi Kalimantan Tengah. **Metode:** Penelitian ini merupakan penelitian deskriptif menggunakan metode survei. Karakteristik yang diteliti adalah *Anopheles* spesies, jumlah, temperatur, salinitas, tempat perindukan, kepadatan larva yang ditemukan di setiap tempat perindukan. **Hasil:** Tujuh tempat perindukan ditemukan positif larva *Anopheles* yaitu genangan air, kolam tanpa ikan, dan selokan. Karakteristik fisik air yaitu suhu berkisar 29,9 $^0$C - 35 $^0$C, pH 5,35 - 6, salinitas 0 ppt dengan tingkat kepadatan larva yaitu 9 larva/2 cidukan. Spesies larva *Anopheles* yang teridentifikasi dalam penelitian ini adalah *An. kochi*. **Kesimpulan:** Tujuh tempat perindukan ditemukan positif larva *Anopheles* di tempat penelitian, yaitu berupa genangan air, kolam ikan tanpa ikan dan selokan. Tempat perindukan ini memiliki karakteristik fisik yang sesuai untuk larva *Anopheles* pada umumnya. *An. kochi* merupakan satu-satunya spesies larva yang ditemukan di semua tempat perindukan.

**Kata kunci:**
*Anopheles*, Tempat perindukan, Kabupaten Gunung Mas, Karakterstik fisik

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## INTRODUCTION

Malaria is an infectious disease that must be controlled by 2030 in order to achieve the S*ustainable Development Goals* (SDGs), along with AIDS and tuberculosis (Ermalena, 2017). Malaria can cause death, especially in at-risk groups, such us infants, toddlers, and pregnant women (Budiyanto and Wuriastuti, 2017). This disease is found in various parts of the world, including tropical and subtropical countries (Aklilu *et al*., 2020). In 2019, there were an estimated 229.000.000 cases of malaria globally, reported across 87 countries (WHO, 2020a). Currently, the provinces with the highest malaria morbidity are Papua, West Papua, and East Nusa Tenggara. Papua is a province with the highest malaria morbidity of 63.12 per 1.000 inhabitants. Malaria endemicity, based on API, was categorized as hypo endemicity (API < 1), moderate endemicity (API = 1 - 5), and hyperendemicity (API > 5). Central Kalimantan, one of the provinces in Indonesia, exhibits low malaria endemicity with a morbidity rate of 0.06 per 1000 populations (Ministry of Health, 2021).

The Provincial Health Office reported a decrease in the number of malaria cases in Gunung Mas District although some areas still contributed to the highest number of malaria cases in Dahian Tambuk Village for four consecutive years, ranked first in Gunung Mas District (Palangkaraya City Health Service, 2021). Epidemiologically, the transmission of this disease is determined by three factors, namely host that consists of humans and mosquitoes, factor agent, plasmodium, and environment covering the physical, chemical, and biological environment (Arsin, 2012). The breeding place is an important factor for the life cycle of *Anopheles* mosquitoes to become a malaria vector with the support of environmental factors (Mayasari *et al*., 2021). Physical environmental such us water temperature can affect the time of hatching of the eggs to release larvae. Water salinity affects vector propagation. A chemical characteristic conducted by Bariyah *et al*. (2021), the water salinity ranges from 0.2 to 1.0 ppm. The pH of Water affects larval propagation. Extreme acidity or alkalinity in water tends to be lethal to organisms (Zamil *et al*., 2021). The average water pH in breeding place found in Bagelan Subdistrict, Purworejo, ranged from 6.4 - 9.2 (Inunggita *et al*., 2019), while in Landak Regency of West Kalimantan Province, it was found to range from 5.0 - 7.6 (Bariyah *et al*. 2021),

The presence of vegetation such as mosses (*Bryophyta*), Pandanus (*Pandanus amaryllifolius*), mangrove (*Rhizophora*), and bamboo can be used by the larvae to shield themselves from direct sunlight and obtain nutrients to survive (Inunggita *et al*., 2019). *Anopheles* larvae are more commonly found in breeding sites that feature vegetation (Getachew *et al*., 2020). This study aims to determine the physical and chemical characteristics of *Anopheles* breeding sites, assess the density of larvae, and identify the species of *Anopheles* larvae in the studied areas, specifically in Dahian Tambuk Village, Gunung Mas District. In other words, this study aims to define the physical and chemical properties of *Anopheles* breeding sites.

## MATERIAL AND METHOD

This study was conducted from April to September 2022. It used a descriptive survey method. The sampling technique employed was total sampling. *Anopheles* larvae were collected using a dipper and a pasteur pipette, then transferred to a bottle using a pipette and labeled with the type of breeding place and the collection date. *Anopheles l*arvae that were found were then marked with coordinates using GPS (Garmin eTrex 10). Measurement of environmental factors included physical and chemical properties such as temperature, pH, and salinity using the EZ-9901. Larval samples were delivered to the Biomedical Laboratory at the University of Palangka Raya for identification. The larva species were identified according to the mosquito key identification book by O'Connor and Soepanto (1999). This research has been approved by the Health Research Ethics Committee of the Palangka Raya University Faculty of Medicine with the certificate number 26/UN24.9/LL/2022.

## RESULT

The distribution of breeding places that tested positive containing *Anopheles* larvae is shown in Figure 1. Seven breeding places of *Anopheles* mosquitoes were found in Dahian Tambuk Village, consisting of puddles, fishponds without fish, and sewers (Table 1). A total of 52 *Anopheles* larvae were collected in Dahian Tambuk village (Table 2).

In the breeding places of *Anopheles*, all stages of larvae development were observed except for pupae. The *Anopheles* larva is characterized by the presence of a pair of antennae and a mouth shaped like a brush on the head, along with a pair of spiracles on the final abdominal segment instead of a siphon. The only species identified in the studied areas was *Anopheles kochi*. This species is characterized by the presence of fine hairs consisting of 7 - 9 branches. The fine hairs on the metathorax resemble flat leaves (O'Connor and Soepanto, 1999; Rattanarithikul *et al*., 2006; Collins *et al*., 2018).

The temperature of breeding places found in the studied areas ranged from 29.9 $^0$C to 35 $^0$C, while the pH levels were 5.35 - 5.85 (Table 1). The salinity was 0, indicating that the breeding places contained fresh water. Based on Table 2, the breeding place with the highest number of larvae was sewer 1, which contained 18 larvae (18.18%). The highest larval density was found in sewer 1, with a density of 9 or 18 larvae/2 dippers, while the lowest was found in puddle 3, with a density of 2 or 8 larvae/4 dippers.

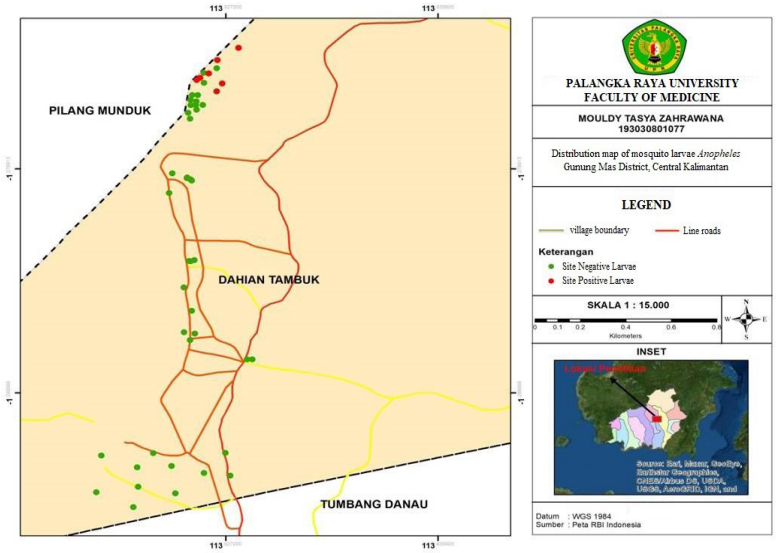


**Figure 1**. Distribution of breeding places that tested positive containing *Anopheles* larvae in Dahian Tambuk Village, Gunung Mas District

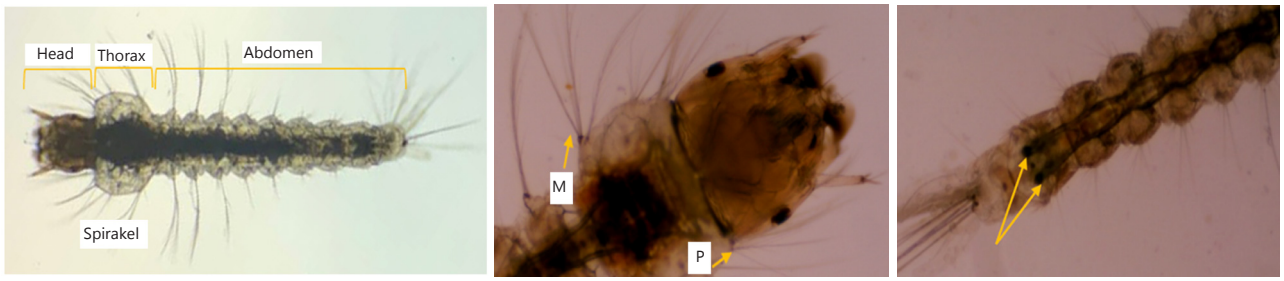


**Figure 2**. Morphology of *Anopheles* larva (Personal Documentation, 2022)

**Table 1.** Physical and chemical characteristics of the breeding places of *Anopheles* larvae in Dahian Tambuk Village

| Type of breeding place | Physical characteristics | | |
|---|---|---|---|
| | Temperature (°C) | pH | Salinity (ppt) |
| Puddle 1 | 33.7 | 5.35 | 0 |
| Puddle 2 | 34 | 5.59 | 0 |
| Puddle 3 | 32 | 6 | 0 |
| Fishpond | 32 | 5.85 | 0 |
| Sewer 1 | 29.9 | 5.50 | 0 |
| Sewer 2 | 31 | 5.6 | 0 |
| Sewer 3 | 35 | 5.59 | 0 |

**Table 2.** The density of *Anopheles* larvae in each breeding place found in studied areas

| No. | Type of breeding place | Results | | Larval density |
|---|---|---|---|---|
| | | Total larvae | Number of dippers | |
| 1 | Puddle 1 | 13 | 4 | 3,25 |
| 2 | Puddle 2 | 13 | 3 | 4,33 |
| 3 | Puddle 3 | 8 | 4 | 2 |
| 4 | Fishpond | 16 | 3 | 5,33 |
| 5 | Sewer 1 | 18 | 2 | 9 |
| 6 | Sewer 2 | 15 | 4 | 3,75 |
| 7 | Sewer 3 | 16 | 3 | 5,33 |
| | **Total** | **99** | **23** | |

## DISCUSSION

The temperature of *Anopheles* breeding places ranged from 29.9 $^0$C to 35 $^0$C. These results were similar to that of Adityo and Kurniati (2018) where the water temperature of breeding places found in the Province of Lampung ranged from 29.3 $^0$C to 35 $^0$C. Whereas Wahono *et al.* (2022) reported that the water temperature of *Anopheles* breeding places in South Sumatra Province ranged from 24 $^0$C to 28 $^0$C. This current study found only one species, identified as *An. Kochi*, which paralleled the finding from the study in South Sumatra, where the temperature of breeding places ranged from 28 $^0$C - 32 $^0$C (Wahono *et al*., 2022).

A high level of acidity or low water pH leads to a decrease in dissolved oxygen reserves and a reduced rate of oxygen consumption, ultimately resulting in the death of aquatic organisms (Rahman *et al*., 2013). The species of *An. kochi* was found within a pH range of 5.35 - 6, consistent with the finding of Maretasari *et al*. (2019) that identified the same species of larvae at pH 5. Additionally, Sugiarti *et al*. (2020) reported finding these larvae within a pH range of 5 - 6.6. The chemical characteristic of the breeding places showed a salinity of 0, indicating freshwater, where the larvae of *An. kochi* was found. A similar finding was also reported by Amirullah *et al*. (2012).

The differences of the density within breeding places are influenced by environmental conditions such as vegetation and larval-eating predators. The denser the water plants in the breeding place, the more increasing the density of larvae because the vegetation acts as a source of food and a shelter to hide from predators (Taviv *et al*., 2015). Prastowo *et al*. (2018) reported that the vegetation found in the breeding place of *Anopheles* spp. included salvinia, ferns, clover, and grass in Borang Hamlet, Kebumen district. The vegetation dominating the breeding place for *Anopheles* larvae in Dahian Tambuk Village were salvinia and grass.

The morphology of mosquito larvae *Anopheles* (Figure 2) can be clearly seen because of its flat position below the water's surface. The absence of siphon and the presence of a pair of spiracles in the last part of the abdomen of *Anopheles* larva were helpful in identifying the genus of *Anopheles*. Instead of siphon, *Anopheles* larva uses spiracles to uptake oxygen from the air; thus, larval position is flat below the water's surface. The head has an antenna and a mouth that resembles a brush, serving to feed on larvae (Setyaningrum, 2020). In addition, clypeus hair, forehead hair, back head hair, and antenna hair were the morphological characteristics of *Anopheles* larvae (O'Connor and Soepanto, 1999). The thorax is divided into prothoracic, mesothoracic, and metathoracic. The front of the chest or prothorax has important hair such as inner shoulder hair, branching middle shoulder hair, and outer shoulder hair (WHO, 2020b). The prothoracic of *An. kochi* has fine hair with 7 - 10 branches (P) and fine hair in methathorax with a flat, leaf-like shape (M) (Rattanarithikul *et al*., 2006). Using the identification keys from O'Connor and Soepanto (1999), Rattanarithikul *et al*. (2006), and WHO (2020b), the mosquito larvae were identified as *An. kochi*.

## CONCLUSION

Seven breeding places of *Anopheles* were found in Dahian Tambuk Village, consisting of puddles, fishponds without fish, and sewers. The water temperature ranged from 29.9 $^0$C to 35 $^0$C, water pH ranged from 5.35 to 6, and salinity was 0 ppt. Sewer was the breeding place with dominant *Anopheles* larvae than other breeding places. The *Anopheles* species identified from all breeding places was *An. kochi.*

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