International Journal Scientific and Profesional (IJ-ChiProf)
Vol.1 Issue.3 August 2022, pp: 144-149
ISSN: 2829-2618 (Online)
DOI : https://doi.org/10.56988/chiprof.v1i3.21

Mosquito Diversity In Livestock Cages

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Article Info
Article history:
Received July 2022
Revised July 2022
Accepted August 2022

Keywords:
Catching
Mosquitoes
Cattle pens

ABSTRACT
Diseases transmitted by mosquitoes are still a health problem in Indonesia, including in Banyuasin Regency, South Sumatra Province. Among the various types of mosquitoes that are vectors of the disease, some prefer animal blood. Research on the diversity of mosquitoes has been carried out in the village of Gasing. The purpose of this study was to obtain an overview of the distribution of mosquito diversity in cattle pens and goat pens. The study was conducted with free collection, namely catching mosquitoes that perch in the cage and outside the catching cage starting from 18.00 to 24.00 WIB. Distribution of the diversity of mosquitoes around the cattle pens in six locations obtained 3 genera and 8 species of mosquitoes from a total of 745 mosquitoes caught. *Culex gellidus* was the most common mosquito found in 291 individuals (39.06%). Meanwhile, there were only 10 *Aedes aegypti* mosquitoes (1.34%) followed by Mansonia Indiana with 11 (1.47%). Based on the time of catching, it was found at 19.01-20.00 WIB as many as 180 fish (24.16%) which began to increase starting at 18.00 WIB. There are fewer cages in a wet environment than in a dry environment. Suggestions for starting a fire around the cage need to be continued and try to keep the cage dry.

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1. INTRODUCTION

Indonesia is a tropical nation with a wide variety of plants and animals and a very large number of vector species, one of which is the mosquito[1]. One of the disease-carrying vectors is the mosquito in humans and animals that are transmitted through their bites. According to research by Nugroho et al., *Aedes (Downsiomyia) pexus*, the first mosquito species to come from Indonesia, as well as six additional species can be found on the island of Sumatra. The Culicidae Sumatra checklist now includes 62 species of mosquitoes that are native to the province of South Sumatra and are divided into 10 genera [2]. Several types of vector-borne diseases are caused by mosquito bites such as dengue fever, malaria, filariasis, chikungunya, *Japanese encephalitis*, and others[3], [4].

Filariasis is a disease transmitted by mosquitoes of the genera *Anopheles, Culex, Aedes*, and *Mansonia* [5]. This disease is caused by blood and tissue nematodes. In Indonesia, 3 types of worms cause filariasis, namely *Brugia malayi, Wuchereria bancrofti*, and *Brugia timori*. The filarial worms that are transmitted by the mosquito vector are found in the probosci's section of the mosquito, when the mosquito sucks the blood of the microfilariae it also enters the definitive host and then matures in the lymphatic system with clinical manifestations of recurrent fever, inflammation of the ducts and lymph nodes, and swelling. on the legs, arms, and genitals at an advanced stage. The vector of filariasis in South Sumatra consisted of the mosquitoes *Mansonia annulifera, Mansonia uniformis*, and *Anopheles nigerrimus*.

In Indonesia, dengue hemorrhagic fever (DHF) is a significant public health issue. The Aedes genus of mosquitoes, one of which is the Aedes aegypti species, is responsible for the transmission of the dengue virus, which causes dengue hemorrhagic fever (DHF) [6]. One of the mosquito species that is endemic to almost all of Indonesia is *Aedes aegypti* [7], [8]. According to a report from the Health Service of the Republic of Indonesia, the number of people experiencing dengue fever has increased since 2014. According to a report from the 2018 Indonesia Health Profile data, the number of DHF sufferers reported was 129,650 cases with the death toll reaching 1,071 people [9].

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This situation is closely related to the increase in population mortality in line with the spread of infectious mosquitoes or vectors carrying the dengue virus in various regions in Indonesia. According to the research of Harapan et al., every year the highest average incidence of dengue hemorrhagic fever is found on Java Island and the lowest on Papua Island [10].

Anopheles spp. mosquito vectors like *An. arabiensis*, *An. coluzzii*, *An. Gambiae*, and *An. funestus* spread the Plasmodium illness, which causes malaria [11]–[14]. This disease causes high morbidity and mortality, especially in endemic areas with tropical and subtropical climates [15].

The prevalence of malaria in Indonesia is 0.4% according to the 2018 Basic Health Research Report (Riskesdas). The incidence of malaria in South Sumatra Province tends to decrease, and several districts/cities had low endemicity for the last 3 years [16].

Japanese encephalitis (JE) is an acute infectious disease that attacks the central nervous system (CNS) which is transmitted by mosquitoes infected with *Japanese encephalitis virus* (JEV) [17], [18]. JEV spreads mainly in rural areas in Asia. The virus is transmitted by the culicine mosquito: the most commonly found vector is *Culex tritaeniorhynchus* which can transmit JEV to both humans and other pets.

Mosquitoes are related to livestock because various types of mosquitoes including vector mosquitoes suck livestock blood[19]. Mosquitoes are more zoophilic. However, if they do not find animals as a source of blood, mosquitoes will suck human blood. Farm animals such as cattle in and near human habitation can attract malaria mosquitoes to human occupants, potentially increasing the risk of malaria [20]. According to research in Simpenan, Sukabumi. Farm animals are also known as hosts for JE disease. A disease caused by JEV by attacking the central nervous system (brain) resulting in sudden inflammation of the brain. Although it can be a host or reservoir for other diseases, the presence of livestock can be a shield or protection from mosquito bites.

Several studies have shown that the presence of livestock significantly reduces the risk of contracting malaria [21]. Research conducted on mosquito fauna around cages has been carried out in North Sumatra and Nigeria. In North Sumatra there were 14 species caught and the most caught were *Culex tritaeniorhynchus, Culexvishnui*, and *Culex fuscocephalus*. In Nigeria, there are 16 species caught and the most dominant is *Culex quinquefasciatus*.

One of the endemic regions is the province of South Sumatra. This province's districts are nearly all plagued by chronic filariasis. There were 226 instances of chronic filariasis up until 2014. In comparison to other districts and cities, Banyuasin district has the most cases of filariasis, with 142 cases and a microfilariae (mf) rate of 1.5. percent Filariasis cases in Banyuasin Regency are spread over 17 sub-districts with the highest cases being in Talang Kelapa District with 22 cases and Sembawa District with 18 cases. The filariasis elimination program in Banyuasin district itself has been launched since 2002, but for all sub-districts in this district, it was only carried out in 2011 so until now the filariasis Mass Drug Administration (POMP) program has been carried out four times.

This is influenced by several factors, one of which is topographical factors. This area consists of water and land areas and is dominated by swamp areas, this is a good habitat for mosquito development [22]. Based on data obtained from the Health Office of South Sumatra Province in 2019, the entomological study conducted in all sub-districts or hamlets in the Musi Banyuasin Regency area has been receptively mapped on the diversity of mosquitoes but not yet in its entirety and it is only in plans that a survey will be conducted.

One of the ways to cut off the transmission of vector-borne diseases is by knowing the diversity of mosquitoes in an area and mapping them so that exposure to humans can be prevented and disease can be prevented. This research was done to determine the variety of mosquitoes near animal cages that have the potential to become disease vectors in the Talang Kelapa District, Banyuasin District, South Sumatra Province.

2. RESEARCH METHOD

This study uses observational research in the form of a field survey on June 4, 2021, in the village of Gasing, Talang Kelapa District, Banyuasin Regency. Samples were taken with a free collection of mosquito catching in the cage and its surroundings starting from 18.00 to 24.00 WIB using an Aspirator. Furthermore, the mosquito species will be identified based on morphological characteristics at the entomology laboratory of the Research and Development Agency of the Baturaja Ministry of Health. There were 745 mosquitoes with 3 genera and 8 species, with the most being *Culex Gellidus* 291 and *Aedes Aegypti* 10.

3. RESULTS AND ANALYSIS

Based on research on Mosquito Diversity in Cattle Cages in Talang Kelapa District, Banyuasin Regency, South Sumatra in 2022. The univariate analysis of this study was the mosquito species. From the results of the analysis that has been carried out on the morphology of mosquitoes in livestock cages, the following results are obtained:

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Table 1. The proportion of mosquito species found

Type of Mosquitoes	N	%
Aedes aegypti	10	1,34
Culex. tritaeniorhyncus	42	5,63
Culex. vishnui	195	26,17
Culex gellidus	291	39,06
Culex quinquefasciatus	143	19,19
Mansonia uniformis	21	2,81
Mansonia Indiana	11	1,47
Mansonia boneae	32	4,29
Total	745	100

The types of mosquitoes found were 10 *Aedes aegypti* (1,34%). *Culex. tritaeniorhyncus* as many as 42 tails (5.63%), *Culex Vishnu* as many as 195 birds (26.17%), *Culex gellidus* as many as 291 birds (39.06%), *Culex quinquefasciatus* as many as 143 birds (19.19%), *Mansonia uniformis* as many as 21 tails (2.81%), *Mansonia Indiana* as many as 11 birds (1.47%), *Mansonia boneae* as many as 32 birds (4.29%) Total 745 birds (99.96%).

Table 2: Distribution of Mosquitoes Found in Cattle Cages by Time

Time (WIB)	Cow stables and goat stables	
	N	%
18.00-19.00	161	21,6
19.01-20.00	180	24,16
20.01-21.00	150	20,13
21.01-22.00	96	12,88
22.01-23.00	80	10,73
23.01-24.00	78	10,46
Total	745	100

Based on table 2, the researchers got the results of catching mosquitoes at 18.00 – 19.00 as many as 161 birds (21.6%), at 19.01-20.00 as many as 180 birds (24.16%), at 20.01 to 21.00 as 150 birds (20.13 %) at 21.01-22.00 as 96 tails (12.88%), at 22.01-23.00 as 80 birds (10.73%) at 23.01-24.00 as 78 birds (10.46%).

Table 3: Distribution of mosquitoes found in cattle pens

Cage Type	N	%
Cowshed 1	81	10,87
Cowshed 2	171	22,95
Cowshed 3	181	24,29
Cowshed 4	64	8,59
Goat cage 1	175	23,48
Goat cage 2	76	10,20
Total	745	100

Based on table 3, the results showed that in cowshed 1 as many as 81 cows (10.87%), cowshed 2 as many as 171 cows (22.95%), cowshed 3 as many as 181 cows (24.29%), cowshed 4 as many as 64 cows (8.59%), goat cage 1 as many as 175 heads (23.48%), goat cage 2 as many as 76 heads (10.20%).

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Table 4: Distribution of mosquitoes found in environmental cattle pens

Environment	N	%
Wetlands	244	32,75
dry land	501	67,25
Total	745	100

Based on table 4, the results were obtained in the wetlands of as many as 244 individuals (32.75%), and dry land of as many as 501 individuals (67.25%).

The dominant mosquito in the capture was the *Culex quinquefasciatus* mosquito. This type of mosquito is found in tropical and sub-tropical areas [23]. These mosquitoes are often found in outdoor areas because at the research location there are many shrubs and trees around the cattle pens which are not far from the residents' homes as a resting place that these mosquitoes like. Ponds and ditches were also found around the fishing grounds because the research location is a tidal area where some of the water does not completely end up in the river, resulting in inundation.

This condition is a good place for *Culex spp*. for resting and breed, thus supporting the density of mosquitoes and supporting their potential as disease vectors. *Culex spp* can be categorized as exophilic mosquitoes except for *Culex quinquefasciatus* which can be categorized as endophilic and tends to suck blood in the house. *Culex spp* is a vector of filariasis and *Japanese Encephalitis Virus* (JEV) [24]. The breeding ground for *Culex quinquefasciatus* is found in various water reservoirs such as drains, septic tanks, wet latrines, organic polluted sites, and puddles [25]. Although this mosquito in Gasing Village has not been proven as a vector of the disease, it is necessary to be vigilant because of the dominant population in the area.

Not only *Culex spp* mosquitoes, *Armigeres sp* mosquitoes. is a vector for filariasis pangi and *Japanese encephalitis*. *Armigers* mosquitoes have a peak of blood-sucking activity at 16.00-17.00 so not many were found at the time of catching in this study because the time of catching started at 18.00 WIB. Other things that can influence the discovery of these mosquitoes are the density of mosquitoes in the ecosystem, the level of rainfall, and the humidity of the research environment. In this study, 671 *Culex sp* mosquitoes were found in Gasing Village and four mosquitoes. This is not in line with Yahya et al., it is known that *Anopheles vagus* and *Anopheles Kochi* in South Sumatra Province are often found in cattle pens, cowsheds, or goats. The Anopheles mosquito breeds only in clean, sunlit water that is not polluted by organic debris, decaying vegetation, and debris.

Cattle cages placed near settlements can play a role in reducing the chance of mosquito bites in humans with the presence of livestock which is the main blood feed of these mosquitoes [19]. *Plasmodium sporozoites* were found in Anopheles vagus in South Sumatra, and the population was quite dominant.

In this study, mosquitoes were found outside and inside the cage. The spread and development of mosquitoes in various habitats are influenced by several factors such as the temperature and humidity of an environment [26]. Anopheles mosquito population density is strongly influenced by changes in temperature, relative humidity, and rainfall[27]. Rain accompanied by heat (increased temperature) and high humidity make the mosquito population will increase after entering the rainy season, but during the long rainy season, the breeding ground for mosquitoes with mosquito larvae will be carried away by the flow of water, this is what causes the distribution of mosquitoes to be disturbed[28].

Wet pen environments are less common because the breeders start fires. The purpose of fumigating the cowshed is so that there are not many flies and mosquitoes, because at the time after it rains there are lots of mosquitoes, this fumigation is done every afternoon until the evening how to repel mosquitoes from the cowshed. In addition, the community plays a role in controlling mosquito-borne diseases [29]. The use of mosquito nets is recommended to reduce mosquito bites in humans [30].

The limitations of this study, are the short sampling time and the sampling season can affect the number of samples obtained so that the number and types of samples obtained cannot represent the true diversity of the population in the sample area location. Also, this study did not further investigate the presence of parasites in vector bodies such as filarial worms, plasmodium, or dengue virus and JE virus. However, this research can be used as basic information for further research on the existing potential vector mosquitoes and can be used as a basis for vigilance in the prevention of vector-borne diseases by the local relevant agencies.

4. CONCLUSION

The results of the identification process using a microscope and a mosquito identification key book in Gasing village found 3 genera, namely *Aedes, Culex*, and *Mansonia* with the proportions 1.34%, 90.05%, and 8.57%, respectively. With eight species, *Aedes aegypti, Culex. Tritaeniorhyncus, Culex. Vishnui, Culex gellidus, Culex*

quinquefasciatus, Mansonia uniformis, Mansonia indiana, and *Mansonia boneae*. The most common proportion of mosquitoes found was *Culex gellidus*. Many mosquitoes were caught at 19.01-20.00 as many as 180 individuals (24.16%), and based on the cage environment, more dry cages were found than in the wet environment, namely 501 individuals (67.25%).

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