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The Risk of Disease Transmission from Bat's Bacteria to Humans and other Animals

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ABSTRACT

Bats are suspected as vectors of some diseases. Bat area roaming large enough and has a complex social structure makes the bat more interesting and unique to discuss the risk of disease transmission to humans and to other animals, especially from bacteria that exist in bats. The study was conducted from March 2017 to March 2018. The research sites in the southern region of Lombok Island consist of SelongBelanak, Semeti, Areguling, Kuta and Tanjung Ringgit. Bats were collected using mistnet Bacterial data collection comes from examination of the mouth, nose, feces, and bowel bats. The identification of bacterial based on colony morphology observation. The results show that there are 14 species of bacteria isolated from 4 species of bats. Species of bacteria are *Providencia stuartii, Aeromonas caviae, Citrobacter freundii, Eschericia coli, Serratia ribidaca, Klebsiella oxytoca, Acinotobacter calcoaceticus, Alcaligenes xylosoxidans, Neisseria siccca, Staphylococcus aureus, Providensia penneri, Proteus vulgaris, Citrobacter freundii,* and *Citrobacter aerogenes.*

Keywords: *Bats, Disease, Bacteria, Humans, Animals*

INTRODUCTION

The existence of bats is very important for people's lives, namely as a complement to the ecosystem, for example, bats can be dispersed fruit seeds including *Annacardiumsp, Adenatherasp, Ceibasp*, Convolvulaceae, Poaceae, *Syzygiumsp, Musa sp, Muntingiasp,* and *Annonasp*, pest control insects, and guano fertilizer producers[1]. In addition, Wijayanti[2] states that bats can act as key providers of ecosystem energy (the key factor in cycle energy) for organisms that are in the cave. Related to this, caves play an important role in maintaining the existence of bats. But there are concerns about humans and animals that interact with bats and concerns about the bat population.

Bats have recently been reported to carry several diseases that are harmful to humans and animals. According to Veikkolainen et.al[3], states that bats are effective reservoirs for the presence of human pathogenic bacteria. Some of these diseases are carried by several organisms or bacteria that live in the body of the bat. Microbes are one that is in the body of a bat. The presence of microbes can have a beneficial and detrimental impact. The beneficial impact on bats as revealed by Hyot, et.al[4] states that bacteria found naturally in bats can inhibit the growth of *Pseudogymnoascusdestructans*. So that it can protect bats from white-nose syndrome (White Nose Syndrome) and some other diseases among influences for individuals, populations, and species. Adverse effects of bats can cause several diseases to humans or other animals. Common types of bacteria found in bats are *Bartonellamayotimonensis*[3,5], *Pasteurellaspp, Leptospirasp, Salmonella sp,* and *E.coli* [6].

The abundance of microbes in bats is quite high, almost all types of bats have species of bacteria with various species that are diverse and even the same. This is caused by the bat's life behavior which consists of many colonies in one perch area. Bats can infect humans and animals because they have a close relationship. For

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example, the human interaction that enters the cave where the bat habitat is located, besides the presence of bats that are close to human settlements and the tendency of humans to use guano as biological fertilizer[7,8]

Based on the description above, researchers feel interested in conducting research on the risk of transmission of diseases from bat bacteria to humans and animals. This research was carried out considering the bat spread is quite broad and very close to the daily lives of humans and animals. This study identified bacteria in several parts of the body of the bat including the mouth (saliva), feces, nose (nasal fluid), the whole body.

MATERIAL AND METHOD

Research Site

The study was conducted from March 2017 to March 2018. The location of the sampling was carried out in the southern part of Lombok Island, the location determination was based on the abundant distribution of bats in the area (9). In addition, the sampling location is a tourist area located on the island of Lombok. The sampling locations included Mount Prabu, SelongBelanak, Semeti, Areguling, Kuta and Tanjung Ringgit. The following is a map of the sampling location in Figure 1.

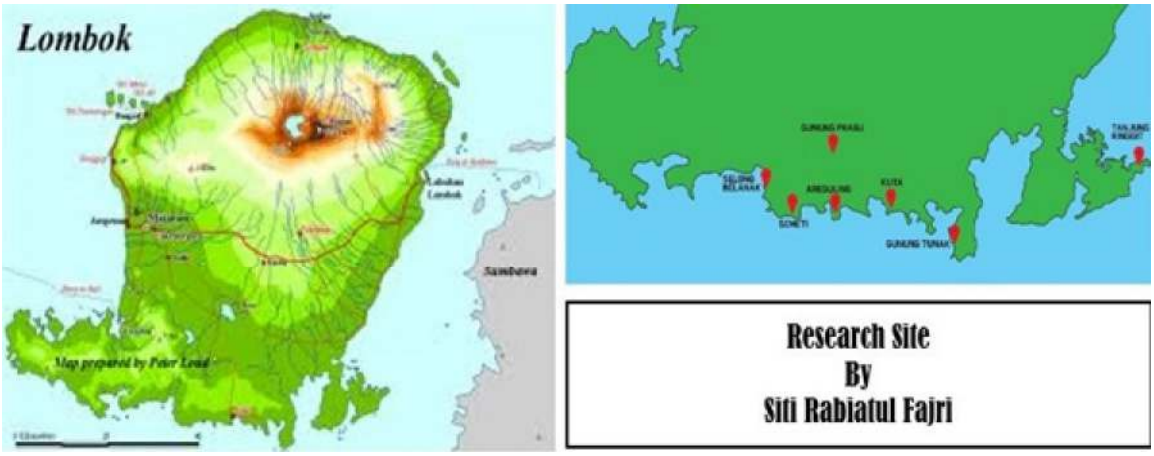

Figure 1. Research Site

Observation of Microba

Examination of microbial samples found in bats by examining several parts of the body from bats includes mouth swabs (saliva), feces, nasal cavity (nasal fluid) and smears throughout the body. Identification of bacteria can be carried out based on colony morphological observations, microscopic observations using various staining reactions and biochemical tests. Colony morphology observations include observation of the shape and color of colonies[10]. Gram staining is used to determine bacterial morphology and distinguish between Gram-positive bacteria and Gram-negative bacteria. Furthermore, bacteria can be identified through various biochemical tests, including carbohydrate fermentation test, Triple Sugar Iron Agar (TSIA) test, motile test, indol test, citrate test, Methyl Red (MR) test and Voges Proskauer (VP) test.

RESULTS

Bacterial examination was carried out on 4 species of bats obtained in 6 locations in the southern part of Lombok Island. Examination of bacteria in 4 bat species is based on the abundance of these species in the southern region of Lombok Island based on Fajri et al[9] report. 4 species of bats include *Eonycteris spaleae, Hipposideros diadema, Rhinophoma microphylum* and *Rhinolopus simplex* (Figure 2).

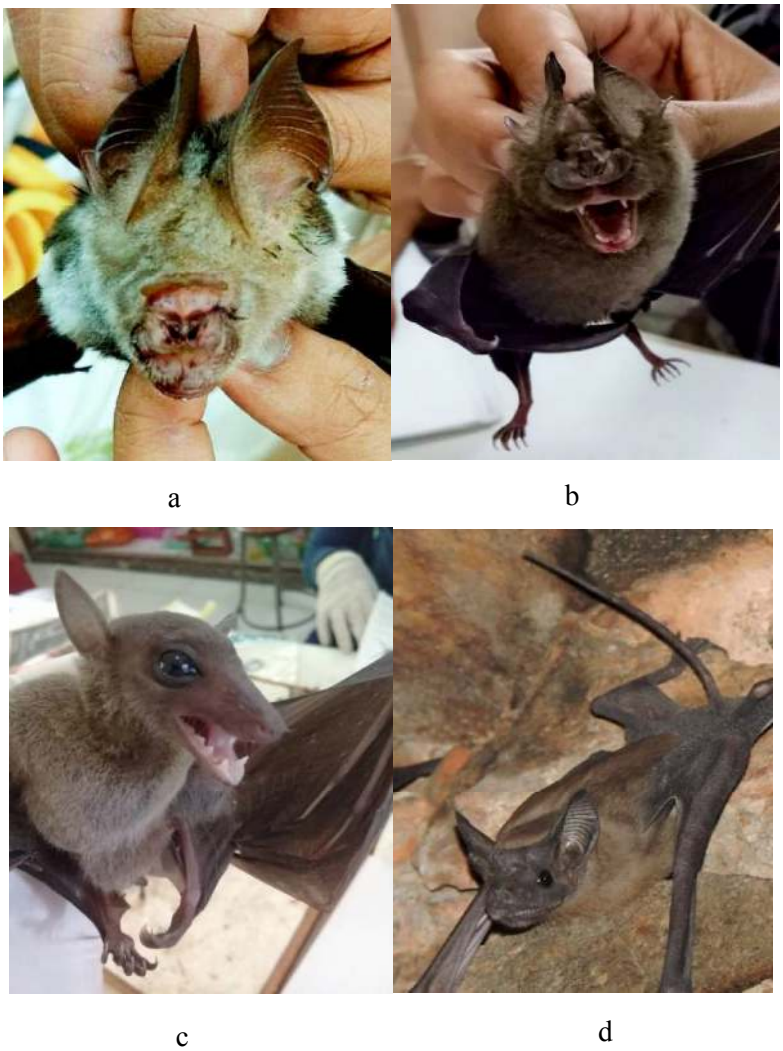

Figure 2. Species of bats; a. Hipposideros diadema, b. Rhinolopus simplex, c. Eonycteris spaleae and d. Rhinophoma microphylum

Based on the results of examination of bacterial species in 4 species of bats, there were 14 species of bacteria that were identified. The species include Providencia stuartii, Aeromonas caviae, Citrobacter freundii, Escherichia coli, Serratia ribidaca, Klebsiella oxytoca, Acinetobacter calcoaceticus, Alcaligenes xylosoxidans, Neisseria sicca, Staphylococcus aureus, Providencia penneri, Proteus vulgaris, Citrobacter freundii, and Citrobacter aerogenes. Example of a bacteria colony in Figure 3.

Figure 3. Colony Bacteria

Eonycteris spaleae is one of the bats that have abundance high enough in the southern part of Lombok Island, its presence in all sampling sites. Considering that this research is interested in identifying bacteria in some parts of the body. based on the results of the study there were 5 bacteria that were identified among themProvidencia stuartii, Aeromonas caviae, Citrobacter freundii, Eschericia coli, and Serratia ribidaca. Hipposideros diademais one of the bats whose existence is found in the Tanjung Ringgit cave and the Buwun cave. This bat successfully identified 6 species of bacteria among themKlebsiella oxytoca, Providensia stuartii, Acinotobacter calcoaceticus, Alcaligenes xylosoxidans, Neisseria sicccaand Eschericia coli. Rhinophoma microphylumis a new record species on the island of Lombok[11]. the existence of this bat is found in the Buwun cave and the Gale-gale Bangkang cave. this study managed to find 2 species of bacteria in the body of Rhinophoma microphylum. the bacterial species include Staphylococcus aureusand Providensia penneri. Rhinolopus simplex is a bat found in Gale-gale Bangkang cave and Buwun cave. from this bat managed to identify 3 species of bats among themProteus vulgaris, Citrobacter freundii, and Citrobacter aerogenes. More details can be seen in Table 1.

Table 1. Microbes in Bats

No	Bat Species	Inspection Location	Gram	Bacterial Species
1	*Eonycteris spaleae*	Mouth (saliva)	Gram-NegativeCocobacil	*Providencia stuartii*
			Gram-NegativeBacil	*Aeromonas caviae*
		Nasal cavity	Gram-NegativeBacil	*Citrobacter freundii*
		Feces	Gram-NegativeBacil	*Eschericia coli*
			Gram-NegativeBacil	*Serratia ribidaca*
		Whole body	Gram-NegativeBacil	*Eschericia coli*
2	*Hipposideros diadema*	Mouth (saliva)	Gram-Negative Bacil	*Klebsiella oxytoca*
			Gram-Negative Bacil	*Providensia stuartii*
		Nasal cavity	Gram-NegativeCocobacil	*Acinotobacter calcoaceticus*
		Feces	Gram-Negative Cocobacil	*Alcaligenes xylosoxidans*
			Gram-Negative Diplococcus	*Neisseria siccca*
		Whole body	Gram-NegativeBacil	*Eschericia coli*
3	*Rhinophoma microphylum*	Mouth (saliva)	Gram-NegativeCoccus	*Staphylococcus aureus*
		Nasal cavity	-	-
		Feces	Gram-NegativeCocobacil	*Providensia penneri*
		Whole body	-	-
4	*Rhinolopus simplex*	Mouth (saliva)	Gram-NegativeBacil	*Proteus vulgaris*
		Nasal cavity	-	-
		Feces	Gram-NegativeBacil	*Citrobacter freundii*
		Whole body	Gram-NegativeBacil	*Citrobacter aerogenes*

DISCUSSION

Based on the results of the study, there were 14 species of bacteria that were identified from several parts of the body of the bat. The goal is to find out what kind of bacteria there are in some parts of the bat's body. Thus, it can be a reference if there is an interaction with bats in their habitat or in human habitation. Bacteria that have been identified are harmful bacteria that can cause disease in organisms that interact with them, for example, humans or other animals. The presence of bacteria in bats comes from food sources and bat-foraging habitats, even

though he knows very little about this. Bacteria found in bats can become reservoirs and zoonotic pathogens in humans and other animals.

Bacteria in this study that are commonly found in bats are *Citrobacterfreundii, Escherichia coli, Klebsiellaoxytoca, Proteus vulgaris, Providenciapenneri, Providenciastuartii*, and *Staphylococcus aureus*. The bacteria have also been reported in bats as reported by Allocati*et*[6] and Muhldorfer[12]. In addition, Muhldorfer[13] states that there are several pathogenic bacteria found in the body of bats that can cause disease in humans and other animals including *Pasteurellasp, Salmonella sp, Escherichia coli* and *Yersinia spp*.

Citrobacterfreundii is an opportunistic bacterium and is also a nosocomial pathogenic bacterium, capable of causing neonatal meningitis among other diseases[14,15,16]. *Escherichia coli*, a pathogenic bacterium, has also been reported in other caves visited by humans, such as Lascaux Cave in France[17], six caves in northern Alabama and northwest Georgia, USA[18], and diverse caves in Mizoram in northeast India[19]. *Klebsiellaoxytoca* is a bacterium that can cause colitis and sepsis, this bacterium also has human defilements (20). *Proteus vulgaris*, generally distributed in soil and water is responsible for approximately 90% of all Proteus infections in humans, especially in the urinary tract. Members of *Providenciasp* are also bacteria commonly found in soil and in water, can cause opportunistic infections in humans, including the urinary tract and eyes, as well as causes of diarrhea, abdominal pain, fever, and vomiting[21]. *Staphylococcus aureus* is one of the bacteria that cause infections in the skin and bacteremia (Sepsis). This bacterium has been reported in *E. Helvum* bats in several regions in Nigeria, Africa[22,23].

The types of bacteria that have never been found before in the body of the bat are *Acinetobactercalcoaceticus, Neisseria sicca, Serratiaribidaca,* and *Aeromonascaviae*. This type of bacteria is very common in humans and some other mammals. *Acinetobactercalcoaceticus* or *Acinetobacterbaumannii* are known as nosocomial pathogens that can cause skin infections in humans. The severe potential caused by *Acinetobacterbaumannii* is bacteremia and pneumonia[24].

Neisseria sicca is a commercial bacterium that is commonly known to be in the upper respiratory tract and is very rarely found to cause meningitis, endocarditis or bacteremia[25,26,27]. In addition, *Neisseria sicca* can cause a decrease in endurance with cutaneous erythematous nodules. This report adds to growing evidence that these bacteria can cause disseminated infections and cutaneous manifestations[28].

CONCLUSION

There are 14 species of bacteria isolated from 4 species of bats. Species of bacteria are *Providencia stuartii, Aeromonas caviae, Citrobacter freundii, Eschericia coli, Serratia ribidaca, Klebsiella oxytoca, Acinotobacter calcoaceticus, Alcaligenes xylosoxidans, Neisseria siccca, Staphylococcus aureus, Providensia penneri, Proteus vulgaris, Citrobacter freundii,* and *Citrobacter aerogenes*.The risk of transmitting the disease to humans or to other animals is quite high. This can be seen from the life cycle of bacteria that involves humans and other animals as hosts and intermediate hosts in completing their life cycles. besides that, some bacteria are also able to cause harm to the body of the bat itself so that it will have an impact on the reduction of the bat population in every habitat.

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Ethical clearance- Taken from Faculty of Education Mathematics and Natural Sciences IKIP Mataram. committee **Conflict of Interest** – None

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The risk of disease transmission from bat's bacteria to humans and other animals(Article)

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