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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 Selong Belanak, 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*, *Escherichia coli*, *Serratia ribidaca*, *Klebsiella oxytoca*, *Acinetobacter calcoaceticus*, *Alcaligenes xylosoxidans*, *Neisseria sicca*, *Staphylococcus aureus*, *Providencia 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 *Annacardium* sp, *Adenathera* sp, *Ceiba* sp, *Convolvulaceae*, *Poaceae*, *Syzygium* sp, *Musa* sp, *Muntingia* sp, and *Annona* sp, pest control insects, and guano fertilizer producers¹. In addition, Wijayanti² 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 *Pseudogymnoascus destructans*. 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 *Bartonella mayotimonensis*^{3,5}, *Pasteurella* sp, *Leptospira* sp, *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, Selong Belanak, 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 colonies¹⁰. 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 al⁹ report. 4 species of bats include *Eonycteris spaleae*, *Hipposideros diadema*, *Rhinophoma microphylum* and *Rhinolopus simplex* (Figure 2).

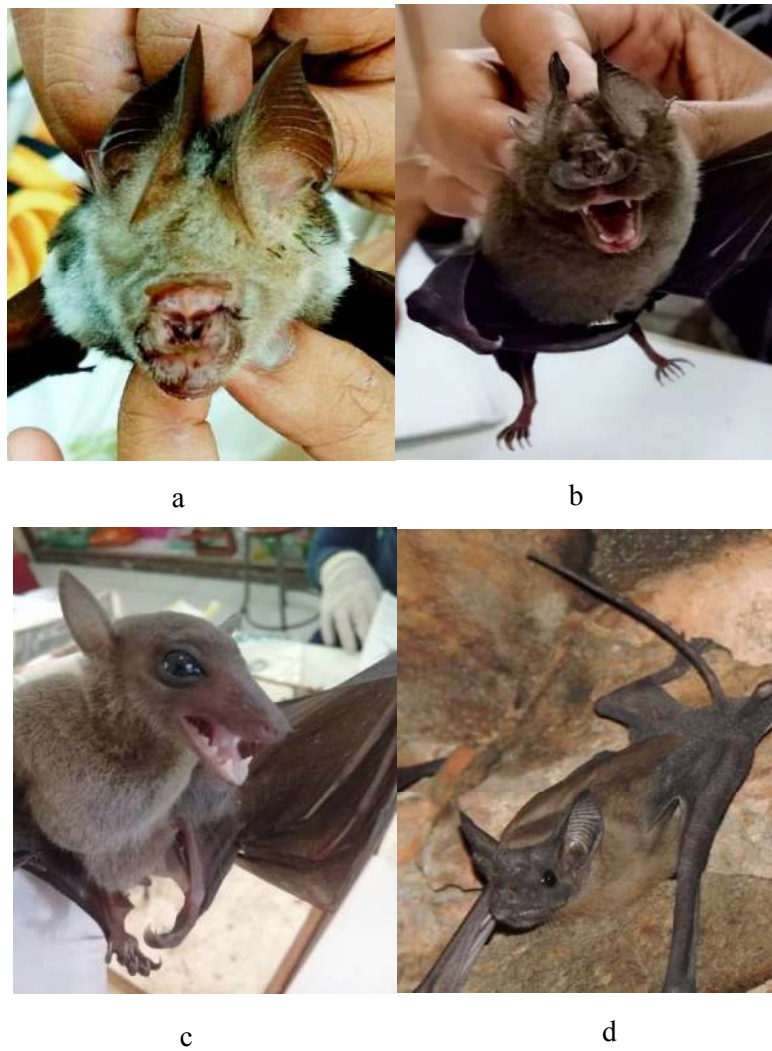


Figure 2. Species of bats; a. *Hipposideros diadema*, b. *Rhinolopus simplex*, c. *Eonycteris spaleae* and d. *Rhinophoma microphylum*

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 them *Providencia 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 them *Klebsiella oxytoca*, *Providencia stuartii*, *Acinotobacter calcoaceticus*, *Alcaligenes*

xylosoxidans, *Neisseria sicca* and *Eschericia coli*. *Rhinophoma microphylumis* a new record species on the island of Lombok¹¹. 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 aureus* and *Providencia 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 them *Proteus 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	<i>Eonycteris spaleae</i>	Mouth (saliva)	Gram-NegativeCocobacil	<i>Providencia stuartii</i>
			Gram-NegativeBacil	<i>Aeromonas caviae</i>
		Nasal cavity	Gram-NegativeBacil	<i>Citrobacter freundii</i>
		Feces	Gram-NegativeBacil	<i>Eschericia coli</i>
			Gram-NegativeBacil	<i>Serratia ribidaca</i>
Whole body	Gram-NegativeBacil	<i>Eschericia coli</i>		
2	<i>Hipposideros diadema</i>	Mouth (saliva)	Gram-Negative Bacil	<i>Klebsiella oxytoca</i>
			Gram-Negative Bacil	<i>Providencia stuartii</i>
		Nasal cavity	Gram-NegativeCocobacil	<i>Acinotobacter calcoaceticus</i>
		Feces	Gram-Negative Cocobacil	<i>Alcaligenes xylosoxidans</i>
			Gram-Negative Diplococcus	<i>Neisseria sicca</i>
Whole body	Gram-NegativeBacil	<i>Eschericia coli</i>		
3	<i>Rhinophoma microphylum</i>	Mouth (saliva)	Gram-NegativeCoccus	<i>Staphylococcus aureus</i>
		Nasal cavity	-	-
		Feces	Gram-NegativeCocobacil	<i>Providencia penneri</i>
		Whole body	-	-
4	<i>Rhinolopus simplex</i>	Mouth (saliva)	Gram-NegativeBacil	<i>Proteus vulgaris</i>
		Nasal cavity	-	-
		Feces	Gram-NegativeBacil	<i>Citrobacter freundii</i>
		Whole body	Gram-NegativeBacil	<i>Citrobacter aerogenes</i>

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 *Citrobacter freundii*, *Escherichia coli*, *Klebsiella oxytoca*, *Proteus vulgaris*, *Providenciapenneri*, *Providenciastuartii*, and *Staphylococcus aureus*. The bacteria have also been reported in bats as reported by Allocatiet⁶ and Muhldorfer¹². In addition, Muhldorfer¹³ 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 France¹⁷, six caves in northern Alabama and northwest Georgia, USA¹⁸, and diverse caves in Mizoram in northeast India¹⁹. *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 vomiting²¹. *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*, *Serratia ribidaca*, 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 pneumonia²⁴.

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 manifestations²⁸.

CONCLUSION

There are 14 species of bacteria isolated from 4 species of bats. Species of bacteria are *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*. 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

REFERENCE

1. Fajri, SR dan Sucika, A. 2015. Analisis Pakan Kelelawar sebagai Polinator dan Pengendali Populasi Serangga Hama: Studi di Gua Gale-Gale Kawasan Karst Gunung Prabu Kuta Lombok Tengah. Jurnal Kependidikan 14 (4): 405-412
2. Wijayanti, Fahma. 2011. Biodiversitas dan Pola Pemilihan Sarang Kelelawar: Studi Kasus di Kawasan Karst Gombong Kabupaten Kebumen Jawa Tengah. Institut Pertanian Bogor.
3. Veikkolainen, V, Vesterinen, EJ, Lilley, TM, Pulliainen, AT. Bats as Reservoir Hosts of Human Bacterial Pathogen, *Bartonella mayotimonensis*.

- Emerging Infectious Diseases*. 2014. www.cdc.gov/eid • Vol. 20, No. 6, June 2014 pp 960-967.
4. Hoyt, JR., Tina L. Cheng, Kate E. Langwig, Mallory M. Hee, Winifred F. Frick, A. Marm Kilpatrick. Bacteria Isolated from Bats Inhibit the Growth of *Pseudogymnoascus destructans*, the Causative Agent of White-Nose Syndrome. *PLoS ONE*. 2015. 10(4): e0121329. doi:10.1371/journal.pone.0121329.
 5. Lilley TM, Wilson CA, Bernard RF, Willcox EV, Vesterinen EJ, Webber QM, Kurpiers L, Prokkola JM, Ejotre I, Kurta A, Field KA, Reeder DM, Pulliainen AT. Molecular Detection of *Candidatus Bartonella mayotimonensis* in North American Bats. *Vector Borne Zoonotic Dis*. 2017 Apr;17(4):243-246. doi: 10.1089/vbz.2016.2080.
 6. Allocati, AG Petrucci, P Di Giovanni, M Masulli, C Di Ilio and V De Laurenz. Bat–man disease transmission: zoonotic pathogens from wildlife reservoirs to human populations. *Cell Death Discovery* (2016) 16048.
 7. Hayman DT, Bowen RA, Cryan PM, McCracken GF, O’Shea TJ, Peel AJ. Ecology of zoonotic infectious diseases in bats: current knowledge and future directions. *Zoonoses Public Health*. 2017.60: 2–21.
 8. Brook CE, Dobson AP. Bats as ‘special’ reservoirs for emerging zoonotic pathogens. *Trends Microbiol* .2015.23: 172–180.
 9. Fajri, SR, Agil dan Hadiprayitno. 2014. Kelimpahan Spesies Kelelawar Ordo Chiroptera Penghuni Gua Di Wilayah Selatan Pulau Lombok NTB. *J Bioedukasi Agustus 2014 Vol 7 No 2*. Hal 42-51
 10. Pelzar, Michael, J and E. C. S Chan. 1986. *Element of Microbiology*. London: McGraw-Hill International Book Company.
 11. Fajri, SR, S.N, Primawati, Islamul, H, Galuh, T. 2018. Bats In The Developed Ecotourism Area Of South Lombok Island West Nusatenggara. *Proceeding in ISBBE 2018*. Jogjakarta
 12. Muhldorfer, K. Bats, bacteria and their role in health and disease. *Microbiology Australia*. 2014. Pp. 28-29
 13. Muhldorfer, K. Bats and bacterial pathogens: a review. *Zoonoses Public Health*. 2013 Feb;60(1):93-103. doi: 10.1111/j.1863-2378.2012.01536.x.
 14. Badger, J.L., Stins, M.F., and Kim, K.S., *Citrobacter freundii* invades and replicates in human brain microvascular endothelial cells: *Infection and Immunity*, 1999. 67:4208–4215.
 15. Chen, Yen-Hsu., Wong, Wing-Wai, Fung, Chang-Phone, Yu, Kwok-Woon and Liu, C.Y. Clinical features and antimicrobial susceptibility trends in *Citrobacter freundii* bacteremia: *Journal of Microbiology, Immunology and Infection*. 2002. 35: 109–114
 16. Tschape, H., Prager, R., Streckel, W., Fruth, A., Tietze, E., and Böhme, G., Verotoxinogenic *Citrobacter freundii* associated with severe gastroenteritis and cases of haemolytic uraemic syndrome in a nursery school: *Epidemiology and Infection*. 1995. 114 : 441–450.
 17. Bastian, F., Jurado, V., Nováková, A., Alabouvette, C., and Saiz-Jimenez, C., 2010, The microbiology of Lascaux Cave: *Microbiology*. 2010. 156 : 644–652.
 18. Campbell, JW., Watson, A., Watson, C., Ball, H., and Pirkle, R. *Escherichia coli*, other coliform, and environmental chemoheterotrophic bacteria in isolated water pools from six caves in northern Alabama and northwestern Georgia: *Journal of Cave and Karst Studies* 2011.73 : 75–82.
 19. De Mandal, S., Sanga, Z., and Nachimuthu SK. Metagenomic analysis of bacterial community composition among the cave sediments of IndoBurman biodiversity hotspot region: *PeerJ Preprints* 2014, 2 :30
 20. Hogenauer, C., Langner, C., Beubler, E., Lippe, IT., Schicho, R., Gorkiewicz, G., Krause, R., Gerstgrasser, N., Krejs, G.J., and Hinterleitner, T.A. *Klebsiella oxytoca* as a causative organism of antibiotic-associated hemorrhagic colitis: *The New England Journal of Medicine*. 2014. 355 : 2418–2426.
 21. Yoh, Myonsun, Matsuyama, J., Ohnishi, M., Takagi, K., Miyagi, H., Mori, K., Park, Kwon-Sam, Ono, T., and Honda, T. Importance of *Providencia* species as a major cause of travelers’ diarrhea: *Journal of Medical Microbiology*. 2005.54 :1077–1082. doi:10.1099/jmm.0.45846-0.

22. Akobi, Babatunji,¹ Oladipo Aboderin,² Takashi Sasaki,³ and Adebayo Shittu corresponding author. Characterization of *Staphylococcus aureus* isolates from faecal samples of the Straw-Coloured Fruit Bat (*Eidolon helvum*) in Obafemi Awolowo University (OAU), Nigeria. *BMC Microbiol.* 2012; 12: 279
23. Olatimehin, Ayodele,¹ Adebayo O. Shittu,¹ Francis C. Onwugamba,² Alexander Mellmann,³ Karsten Becker,² and Frieder Schaumburg². *Staphylococcus aureus* Complex in the Straw-Colored Fruit Bat (*Eidolon helvum*) in Nigeria. *Front Microbiol.* 2018; 9: 162.
24. Fournier, PE, Hervé, R, Weinstein, RA.. The Epidemiology and Control of *Acinetobacter baumannii* in Health Care Facilities *Clinical Infectious Diseases*, 2006. 42 : 692–699
25. Johnson AP. The pathogenic potential of commensal species of *Neisseria*. *J Clin Pathol.* 1983;36:213–23
26. Feder HM Jr, Garibaldi RA. The significance of nongonococcal, nonmeningococcal *Neisseria* isolates from blood cultures. *Rev Infect Dis.* 1984;6:181–8
27. Entesari-Tatafi, Damoon, Mohammad Bagherirad, Doreen Quan, and Eugene Athan 2014. Iatrogenic Meningitis Caused by *Neisseria sicca/subflava* after Intrathecal Contrast Injection, Australia. *Emerging Infectious Diseases.* 2014. 20(6) :xx-xx
28. Jung JJ, Vu DM, Clark B, Keller FG, Spearman P. *Neisseria sicca/subflava* bacteremia presenting as cutaneous nodules in an immunocompromised host. *Pediatr Infect Dis J.* 2009. 28(7):661-3.

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

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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*, *Escherichia coli*, *Serratia ribidaca*, *Klebsiella oxytoca*, *Acinetobacter calcoaceticus*, *Alcaligenes xylosoxidans*, *Neisseria sicca*, *Staphylococcus aureus*, *Providensiapenneri*, *Proteus vulgaris*, *Citrobacter freundii*, and *Citrobacter aerogenes*. © 2018, Indian Journal of Public Health Research and Development. All rights reserved.

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