DIVERSITY AND ROOSTING CHARACTERISTIC OF BATS IN BUNI AYU CAVE, SUKABUMI LIMESTONE AREA, WEST JAVA

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ABSTRAK

Wiantoro, S. 2012. Penelitian keanekaragaman dan karakteristik tempat bertengger kelelawar di Gua Buni Ayu, Desa Cipicung, Kecamatan Nyalindung, Kabupaten Sukabumi, Jawa Barat. *Zoo Indonesia* 21(1), 33-37. *Penelitian keanekaragaman dan karakteristik tempat bertengger kelelawar di Gua Buni Ayu, Desa Cipicung, Kecamatan Nyalindung, Kabupaten Sukabumi, Jawa Barat dilakukan untuk mengetahui keanekaragaman jenis kelelawar dan karakter spesifik tempat bertenggernya. Metode yang digunakan dalam penelitian ini antara lain jaring kabut, jaring bertangkai dan observasi. Selain itu, pengukuran suhu dan kelembaban relatif juga diukur di setiap tempat bertengger. Dari penelitian ini diketahui sebanyak 504 individu kelelawar yang terdiri dari empat jenis yaitu Hipposideros diadema, Hipposideros galeritus, Rhinolophus affinis dan Miniopterus magnater berada di Gua Buni Ayu. Bentuk fisik lorong gua diketahui merupakan faktor penting yang mempengaruhi jenis-jenis kelelawar dalam menentukan tempat bertenggernya. Rerata suhu udara berkisar antara 26.67-28.46 ^{0}C, sedangkan kelembaban udara berkisar antara 81.5-84.48%. Perbedaan suhu dan kelembaban udara yang relatif kecil tersebut tidak mengindikasikan adanya pengaruh terhadap perilaku pemilihan tempat bertengger di Gua Buni Ayu dan kisaran tersebut masih dalam kisaran normal bagi kelelawar untuk tetap bisa bertahan hidup.*

Kata Kunci: *Kelelawar, tempat bertengger, gua, Buni Ayu*

ABSTRACT

Wiantoro, S. 2012. A study on the diversity and roosting characteristic of bats in Buni Ayu Cave, Cipicung village, Nyalindung District, Sukabumi, West Java. *Zoo Indonesia* 21(1), 33-37. *A study on the diversity and roosting characteristic of bats in Buni Ayu Cave, Cipicung village, Nyalindung District, Sukabumi, West Java was conducted to see if there were any specific characteristics of species' roosting sites. Misnetting, hand collecting and observations were used to identify species and observe their roosting sites. Temperature and relative humidity was recorded at each roost site. A total of 504 individuals from four species of bats were recorded. The species were Hipposideros diadema, Hipposideros galeritus, Rhinolophus affinis and Miniopterus magnater. The physical shape of the cave passage was found to be the main factor for the choice of a roosting site. Microclimate results showed that the mean air temperature was around 26.67-28.46 ^{0}C and the relative humidity was 81.5 to 84.48 %. The small range in the temperature and relative humidity indicated that they did not influence the roosting behavior and were within the range shown to be suitable for bats.*

Keywords: *bats, roosting, cave, Buni Ayu*

INTRODUCTION

Buni Ayu Cave is one of the tourist attractions of the Sukabumi limestone area. Administratively, this cave is located in Cipicung Village, Nyalindung District, Sukabumi Regency, West Java Province. The presence of bats in the cave is one of the features for cave tourism as well as cave ornaments such as stalactites, stalagmites and gordyns.

Ecologically, bats have an important role inside as well as outside of the cave ecosystems. The bat faeces (guano) is a primary source of food for organism in the cave and contains a rich source of nutrients for obligate invertebrate cave inhabitants (Welbourn 1999). Guano is one of the best fertilizers for agricultural crops because it has organic material which is rich in phosphates and nitrates (Werner &

Dindal 1987). Bats have also an important role in the ecosystem outside of the cave. Insectivorous bats are one of the primary predators for night-time insects including some that are potential pests, and bats are regarded as controlling agents for regulating insect populations (Kunz 1998). In addition, fruit bats which are also found in the area, and that choose fruit, nectar and pollen as their food, also have an important role as seed disperser and pollinator, and play an important part in the forest ecosystem (Nowak 1995).

Many bat species are obligate cave-dwellers and the existence of caves is needed for these bats as roosting sites. More than half of Indonesian microchiropterans choose caves as their roosting area (Suyanto 2001). Bats that roost in caves also chose caves as nursery sites. They leave their babies inside the cave when they go out to feed at night (Nowak 1995).

Previously it seems that no published report about the bats in Buni Ayu Cave. This has caused a lack of information on their diversity and population numbers, which is necessary for manage this tourist cave. The objective of this study was to see if different species of bats selects its preferable roosting place within the cave, and species count and its individual number encountered in the cave.

RESEARCH METHODS

Study area

The study was conducted in Buni Ayu Cave, Sukabumi Limestone area, West Java (S 07°02'08.3" E 106°54'20.5") (Figure 1). Administratively, this cave is located in Cipicung Village, Nyalindung District, Sukabumi Regency, West Java Province. This cave is also known as Cipicung Cave. Buni Ayu Cave is a long horizontal cave which has three passages (total length of approx. 1500 m) with various chambers and a river system (Figure 1).

Diversity of bats

The diversity of bats in Buni Ayu Cave was surveyed using three methods: mistnetting, hand

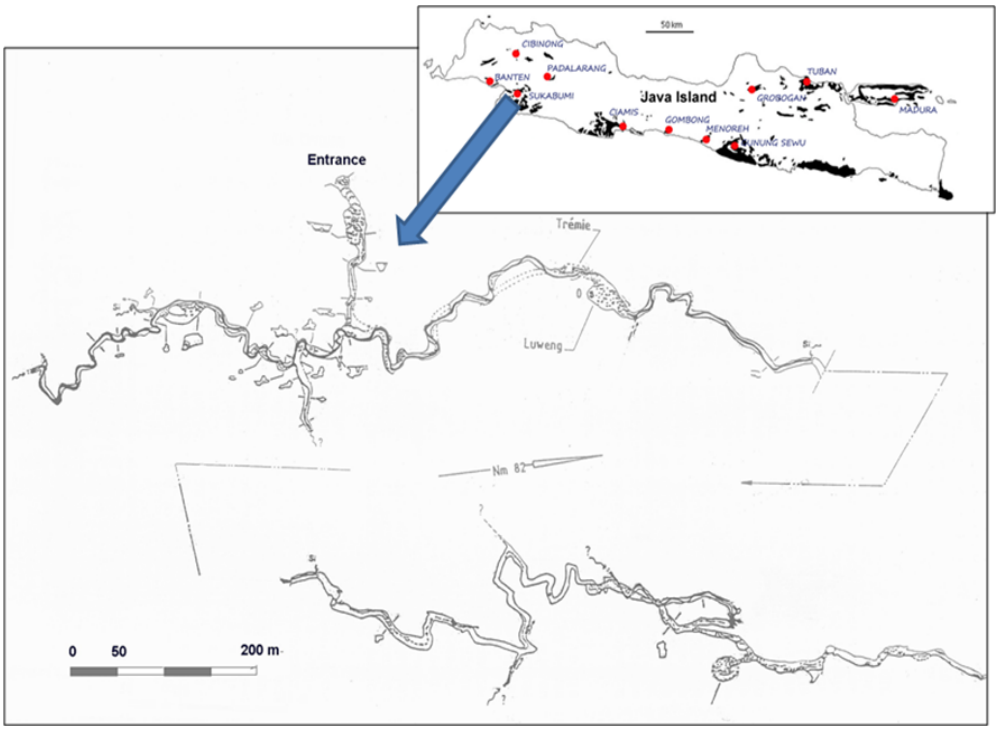

Figure 1. Map of the Buni Ayu Cave in Sukabumi limestone area, West Java

collecting, and observation. A mist net (two ply polyester 75d with 31 mm mesh size; 2.7 m in height; 12 m in lengths) was set up in front of the cave at the commencement of the bat fly out at 1730 hours and maintained until 2000 hours. Hand collecting using a long-handled net was used to collect bats at their roosting site inside the cave. Observations using bright headlamps were used to locate the position of roost sites and to estimate the population numbers for each species. Body measurements of captured bats were taken using a digital caliper for variables of weight (W), head and body length (HB), tail length (T), ear length (E), tibia length (Tb), forearm length (FA) and hind foot length (HF). Sex and age were also determined. Specimens were identified and deposited in the Museum Zoologicum Bogoriense (MZB)-LIPI.

Roost characteristics

Characteristic features for the roost site for all species were recorded by measuring the physical dimentions and microclimate parameters in each roost. Physical parameters measured were the width and height of the cave passage, while the microclimate recording were air temperature and humidity.

RESULTS AND DISCUSSION

A total of 504 individuals, comprising four species from three families of bats were recorded in the cave. All four species were members of the microchiroptera (Table 1). All microchiropterans have the ability to echolocate and use this ability to navigate, forage for food and occupy a niche where there are many insect available for their prey (Hill & Smith 1984). This ability to echolocate also gives them capability to choose their roosts in an area of total darkness, such as caves.

Species Accounts

***Hipposideros diadema* (E. Geoffroy, 1813) (Diadem Leaf-nosed Bat)**

Body measurements: W 48-71 gram, HB 85.49-95.90 mm, E 23.75-30.65 mm, FA 80.80-89.65 mm, Tb 34.52-37.91 mm, HF 17.99-25.70 mm, T 44.47-52.03 mm.

Roosting characteristic: Colonies of this species occupied big chambers which have the widest and highest passages in the cave. A previous study of this species on Bismarck Island recorded that this species roosted in a big chamber inside the cave (Werner & Dindall 1987). *H. diadema* is one of the largest microchiropterans which may require more space for a roosting site. The air temperature at the roost sites ranged from 25.3-28.2^{o}C, whereas the humidity ranged from 76-89%. These microclimate parameters are within the optimum microclimate for a bat suggested by Kunz (1998).

Note: This species has wide range of distribution start from Burma and Vietnam through Thailand, Laos, W Malaysia and Indonesia (including Sumatra, Borneo, and Bali) to New Guinea, Bismarck Arch., Solomon Isls and NE Australia; Philippines; Nicobar Isls.

Tabel 1. List of bat species and the estimation of population size in Buni Ayu Cave

Family	Species	∑ Colony	Population estimation (indv)
Hipposideridae	*Hipposideros diadema*	3	300
	Hipposideros galeritus	2	49
Rhinolophidae	*Rhinolophus affinis*	3	108
Vespertilionidae	*Miniopterus magnater*	3	47
TOTAL		11	504

***Hipposideros galeritus* Cantor, 1846**
(Cantor's Leaf-nosed Bat)

Body measurements: W 7-9 gram, HB 49.08-53.02 mm, E 11.59-12.19 mm, FA 50.36-52.07 mm, Tb 20.86-21.50 mm, HF 6.94-7.38 mm, T 37.29-43.90 mm.

Roosting characteristic: *H. galeritus* is much smaller than *H. diadema*. This species roosted in cave passages which were wider compared to the roosting area of *R. affinis* and *M. magnater*, but had a lower roof compared to the roosting site of *H. diadema*. The width of passage ranged from 6-15 m and the roof height ranging from 1-1.5 m. The air temperature and humidity of this species' roosts were slightly higher but in the same range as measured for *H.diadema*.

Note: distribution of this species start from Sri Lanka and India through SE Asia (including Burma, Thailand, and Peninsular Malaysia) to Java and Borneo; Sanana Isl (Sula Group, Moluccas Isls).

***Rhinolophus affinis* Horsfield, 1823**
(Intermediate Horsheshoe Bat)

Body measurements: W 13-18 gram, HB 49.52-59.08 mm, E 18.62-21.34 mm, FA 51.67-54.72 mm, Tb 23.37-25.27 mm, HF 9.83-11.00 mm, T 19.92-26.45 mm.

Roosting characteristic: In Buni Ayu Cave, three colonies of this species were found in narrow passages with a low roof. The width and height of the passages that were used by this species was almost the same as the roosting sites of *M. magnater*, but observations showed that the roosts of *R. affinis* contained a lot of cave ornaments in the roosting sites, such as stalagtites. A lot of individuals roosted in the spaces between the cave ornaments and some bats roosted on the tip of the stalagtites. This species is known to have a slow flight speed with high maneuver ability (Hill & Smith 1984), so this would favour the species easily roosting in the narrower passages with a lot of obstacles.

The temperature and humidity of the roosts for this species were in the same range as measured for other species (Table 2).

Note : distribution of this species start from India and Nepal to S. China and Vietnam, through Malaysia to Borneo and Lesser Sunda Isls; Andaman Isls (India); perhaps Sri Lanka.

***Miniopterus magnater* Sanborn, 1931**
(Western Long-fingered Bat)

Body measurements: W 12-17 gram, HB 50.75-63.6 mm, E 9.4-10.42 mm, FA 48.76-51.65 mm, Tb 20.35-23.13 mm, HF 9.26-10.91 mm, T 53.95-63.34 mm.

Roosting characteristic: Roosting sites of this species were almost the same as with the roosting sites of *R. affinis*. It differs for *M. magnater* by having no cave ornaments such as stalactites. Some individuals of this species roosted in crevices at their roosting sites. Members of the genus *Miniopterus* are known as fast flyers with low maneuverability. So, this species prefers to choose cave passages with no cave ornaments as their roosting site.

Temperature and humidity of the roost sites for this species was in a similar range to those recorded for the other three species (Table 2).

Note: distribution of this species start from NE India, SE China, Burma, Thailand, Laos, and Vietnam to Malaysia, Sumatra, Java, Timor (Indonesia), Borneo, Moluccas, and New Guinea including the Bismarck Arch.

Bats need a roosting site which has a suitable environment for their physiology, social activities, morphological characters and predator avoidance (Kunz 1998). Caves are one of the primary choices for bats as their roosting site. The shape of cave passages was found to have no effect on the condition of the cave environment, but did have an effect on the diversity of bats (Kencana 2001). Based on the physical and microclimate parameters recorded in the present study in Buni Ayu Cave (Tabel 2),

Tabel 2. Physical and microclimate parameters in bat roosting sites in Buni Ayu Cave.

Physical and microclimate parameters	*H. diadema*	*H. galeritus*	*R. afinis*	*M. magnater*
Width of passage (m)	6.6 (5-10)	8.12 (6-15)	3 (2-5)	3.62 (2-7)
Height of roof (m)	5.4 (4-8)	1.71 (1-1.5)	1.41 (1-2)	1.83 (0.5-3)
Air temperature (^oC)	26.67 (25.3-28.2)	28.46 (28.1-28.7)	26.68 (25.7-28.7)	28.13 (26.6-29.2)
Relative humidity (%)	84.11 (76-89)	81.50 (78-85)	84.48 (78-88)	84.11 (77-90)

values in the parentheses indicate minimum and maximum values

bats preferred to colonize in groups consisting of one species only, as indicated by the fact that all bats recorded were found only in single species groups.

Based on the microclimate condition, roosting sites in almost all sites had a similar range in each roosting site. The air temperature ranged in all sites ranged from 25.3-29.2^oC and humidity ranged from 76-90%. According to Kunz (1998) the normal condition for a roosting site of bat is where the air temperature ranges from 20-30^oC and the relative humidity ranges from 60-90%. The air temperature inside large caves approximates the outside mean annual temperature (Hall & Richards 2003). The mean annual temperature at Cipicung is 28.5^oC which is within the range measured and expected in Buni Ayu Cave. On the other hand, it is not known the impact of the numbers of visitors and electric lighting can affect the microclimate of tourist caves or disturb the roosting behavior of bats.

Findings of this study indicated that *H. diadema* which has the biggest body size compared to the other three species, utilizes the roosting sites in the cave with the largest dimensions of chamber. *M. magnater* which has limited of flight maneuverability tended to choose roosting sites with no obstacles such as no cave ornaments, while *R. affinis* with more agile maneuverability prefers roost in sites with cave ornaments. Interspecific competition may also be a factor affecting roost site selection in Buni Ayu Cave as indicated by no mixed species colonies being found.

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