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Use of roof as roost of *Eumops perotis* (Molossidae: Chiroptera) in southeast Brazil

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ABSTRACT. The bat *Eumops perotis* (Schinz, 1821) is broadly distributed in the Americas. Studies on its biology are still scarce and the few studies available are relatively outdated. In the present study, we describe the biology of *Eumops perotis* in an artificial roost in the municipality of Pindorama, State of São Paulo, southeastern Brazil, which was monitored for 12 months. We captured 50 individuals; 43 adults (34 males and 9 females) and seven juveniles (three males and four females). Nineteen adults were recaptured throughout the year (15 males and four females) during samplings. Males were ~33% heavier than females. Males remained in the roost throughout the year, while females were absent in June, July, and August. The presence of males with scrotal testes and pregnant females from July to November and the presence of pregnant females and pups from February to April suggest monoestry for this colony. Inside the roost, the behavior of *E. perotis* was similar to other molossid bats (e.g. contact posture, formation of groups, and presence of isolated males). During winter, the individuals of this colony consumed mostly coleopterans, but their diet also included orthopterans and lepidopterans, mainly in the summer. Therefore, this study contributes to increase the knowledge of the natural history of this species in the Neotropical region.

KEYWORDS. Reproductive biology, biometrics, behavior, diet.

RESUMO. Uso do telhado como abrigo por *Eumops perotis* (Molossidae: Chiroptera) no sudeste do Brasil. O morcego *Eumops perotis* (Schinz, 1821) é amplamente distribuído nas Américas. Os estudos sobre a biologia ainda são escassos e os poucos disponíveis estão relativamente desatualizados. No presente estudo, descrevemos a biologia de *E. perotis* em um abrigo artificial no município de Pindorama, Estado de São Paulo, no Sudeste do Brasil, monitorado por 12 meses. Nós capturamos 50 indivíduos, 43 eram adultos (34 machos e nove fêmeas) e sete juvenis (três machos e quatro fêmeas). Dezenove adultos foram recapturados ao longo do ano (15 machos e quatro fêmeas) durante as amostragens. Os machos eram ~ 33% mais pesados que as fêmeas. Os machos permaneceram no abrigo ao longo do ano, enquanto as fêmeas estavam ausentes em junho, julho e agosto. A presença de machos escrotados e fêmeas grávidas entre julho e novembro e de fêmeas prenhas e filhotes de fevereiro a abril sugere a monoestria para esta colônia. Dentro do abrigo, o comportamento de *E. perotis* foi semelhante a outros morcegos molossídeos (e.g., postura de contato, formação de grupos e presença de machos isolados). Durante o inverno, os indivíduos desta colônia consumiram principalmente coleópteros, mas sua dieta incluiu também ortópteros e lepidópteros, principalmente no verão. Portanto, este estudo contribui para um aumento no conhecimento sobre a história natural desta espécie na região Neotropical.

PALAVRAS-CHAVE. Biologia reprodutiva, biometria, comportamento, dieta.

The western mastiff bat *Eumops perotis* (Schinz, 1821) is widely distributed along the Americas (Eger, 2007; Suckow *et al*., 2010; Caire & Loucks, 2013) and is considered the largest species of the genus, with length of forearm between 73 and 83.4 mm (Barquez *et al*., 1999; Gregorin & Taddei, 2002). This bat species is classified as aerial-insectivorous and consumes mainly insects of the orders Lepidoptera, Orthoptera, Hymenoptera, Coleoptera, Odonata, and Hemiptera (Freeman, 1979; Reis *et al*., 2007).

Eumops perotis is considered polyestrous and monotocous (Carter, 1970; Taddei, 1980), and rarely gives birth to two pups (Best *et al*., 1996). In the Northern portion of America, reproductive individuals of *E. perotis* were recorded in March, April, June, July, and August, nursery colonies were also recorded in August (Cockrum, 1960; Barbour & Davis, 1969; Myers & Wetzel, 1983). In Brazil, male bats with apparent scrotal testes were captured in June and July in the state of Rio de Janeiro (Peracchi & Albuquerque, 1971). In the southern area of South America, in the Chaco region, a pregnant female was recorded in October (Myers & Wetzel, 1983).

This bat species roosts in rock crevices, hollow trees, and attics of buildings (Barquez *et al*., 1999; Fabián & Gregorin, 2007), where it forms heterosexual colonies (Grinnell, 1933; Krutzsch, 1955; Ohlendorf, 1972). Colonies either remain in the same roost throughout the year (Easterla, 1972) or change between seasons (Barbour & Davis, 1969; Pierson & Rainey 1996), with some records of solitary individuals using temporary roosts (Barbour & Davis, 1969). In general, roosts are at a minimum height of 2 m

above ground, a characteristic that is related to the need for this species to drop from a given height for takeoff (Best *et al*., 1996; Fabián & Gregorin, 2007; Caire & Loucks, 2013).

Roosts can provide sites for mating, nursing, social interaction, digestion, urination, defecation, climatic stability, and shelter from predators (Kunz, 1982; Kunz & McCracken, 1996; Kunz & Lumsden, 2003). Therefore, conditions and events inside the roost play an important role in bat ecology and evolution (Kunz, 1982). In addition, bat population continues to decline in many parts of the World and the loss of such roosts is having an enormous impact on the density and distribution of local bat fauna (Fenton, 1997; Kunz & Lumsden, 2003). Thus, considering that the information available on *E. perotis* colonies is scarce in Brazil (Reis *et al*., 2007; Fabián & Gregorin, 2007; Pacheco *et al*., 2010), this study aims to describe: the biology of *E. perotis* roosted in an attic in southeastern Brazil; the physical characteristics of the roost, colony composition, sexual dimorphism, behavior inside the roost (e.g., posture, nursing), and the items consumed by this species during the seasons.

MATERIAL AND METHODS

Study area. The present study was carried out in a rural property in the municipality of Pindorama, state of São Paulo, southeastern Brazil. Bats used the roof of a building (located between the coordinates; SIRGAS 2000, 21°11'30.76"S – 48°53'31.92"W, 521 m a.s.l.) as roost. The forest remnant belongs to the Atlantic Forest and its predominant phytophysiognomy is characterized as seasonal semideciduous forest. The vegetation of the area is highly degraded and is comprised mainly of the native bamboos *Guadua* Kunth (Gramineae, Poaceae), *Nectandra megapotamica* (Spreng.) Mez (Lauraceae), *Pterogyne nitens* Tul (Fabaceae), and exotic species, such as *Eugenia jambolana* Lam. (Myrtaceae) and *Eucalyptus camaldulensis* Dehnh 1832 (Myrtaceae). Climate in the region is classified as "Aw" (tropical hot and humid) according to Köppen's system, with two seasons: rainy austral summers (October to March) and dry austral winters (April to September; Rolim *et al*., 2007). During the study period, annual rainfall was 124.42 (SE ± 36) mm, which exceeded the annual average. Rainfall was 20.48 (SE ± 5.23) mm during dry season and 228.46 (SE ± 37.32) mm during rainy season. The average annual temperature was 34°C (SE ± 0.67); 32°C (SE ± 1.12) during dry season and 35°C (SE ± 0.35) during rainy season (CIIAGRO, 2017).

Bat capture. We captured bats monthly from March 2005 to February 2006 with six mist nets (12 x 2.5 m) set up facing both accesses used by the bats. We fixed the mist nets with timber poles and cords so that three nets became interpolated, one over the other, to reach six meters in height. Each set was assembled at a maximum distance of 2 m from each of the accesses. We carried out five night captures monthly, from 6:00 p.m. to 4:00 a.m., with a total mist-net area of 9000 m^2.h. We considered all captures coming out of the attic as bats leaving the roost and all captures in the opposite direction as bats returning to the roost.

After each bat was captured, we recorded the following data: time of exit from or return to the roost, height (meters above ground) of the capture (1-5 m height), estimated age class (i.e., juveniles and adults), sex, and reproductive condition. Age class was determined through the ossification degree of the epiphyses of the long bones (Brunet-Rossinni & Wilkinson, 2009). Males were divided in two classes: with scrotal testes and with abdominal testes (Racey, 1988). Females were considered as inactive, pregnant (when the presence of fetus was confirmed after palpation), or lactating (when nipples showed secretion; Racey, 1988). We measured body weight with a Pesola® dynamometer (precision 1.0 g) and forearm and body length with a digital caliper (precision 0.1 mm). Body length was obtained by measuring from the postorbital region (i.e., base of the rostrum) to the base of the tail. For this measurement, the animal was placed in dorsal decubitus, with the palatal dome parallel to the table (i.e., lying on its back). After these procedures, each captured specimen was marked with metal rings on its forearms, in order to identify how many individuals comprised the colony, and was then released at the same capture location.

Behavior of bats inside the roost. In six occasions (i.e., bimonthly from March 2005 to February 2006), we performed visual inspections inside the roost. These inspections were the only ones performed to minimize the possible stress that could lead bats to leave the roost (Lewis, 1995). During each visit, we observed, and whenever possible, photographed the bat colony. Where possible, we recorded the posture adopted by individuals based on their contact with the substrate (see details Villa-R, 1966; Breviglieri & Uieda, 2014): 1) Contact Posture, the bats were found hanging, clinging to the roughness of the vertical wall with the aid of their feet and leaning against the same roost wall with their thumbs, wings folded laterally around the body, with or without having their bellies in contact with the substrate; 2) Free Posture, the bats hung from the roost ceiling with the help of their feet, wings folded laterally around the body with no contact between the substrate and their bellies, backs, or thumbs.

Bat guano examination. To analyze the diet of *E. perotis*, we sampled the feces accumulated on the floor of the attic and at a distance of 30 cm from the walls. Fecal samples were weighed on a digital balance, and the items found were sorted using an electronic stereomicroscope. The fragments were identified to the order with the help of bibliography and specialized taxonomists (e.g., Borror & DeLong, 1988; Whitaker *et al*., 2009).

Data analyses. We used the Student t test to test for sexual dimorphism in forearm length, body length, and weight. To analyze the overnight capture rate during the months sampled, we used a simple linear regression. All analyses were carried out using the R version 3.1.2 (R Development Core Team, 2016), considering $\alpha = 0.05$. The data were transformed to log (x+1) whenever necessary.

RESULTS

Roost location and characteristics. The attic used by the bat colony had an area of 12 m^3 and most of the space was occupied by two 1,500 L water tanks placed one upon the other. Bats had only two accesses of 4 cm^2 located at the joints of roof tiles with aluminum rain gutters that bordered the roof and 4 m above the ground. These accesses face opposite directions: one south and the other north. The surrounding habitat was comprised of pastures, sugar cane crops, and a riparian forest fragment located 110 m away from the roost. The average temperature inside the roost was 25°C (SD = 3.46, N= 6) during dry season (April to September) and 34°C (SD = 4.56, N=6) during rainy season (October to March).

Captures examined. In 60 sampling nights, we captured 50 individuals of *E. perotis* (Tab. I) using mist nets; 43 were adults (34 males and 9 females) and seven were juveniles (three males and four females). The average (± SD) number of captures with mist nets was 1.13 ± 0.49 individuals per night and 4.17 ± 2.76 individuals per month. We observed a gradual reduction in the number of captures with mist nets between the first and fifth nights of capture in each month ($r^2 = 0.95$, $p = 0.001$).

Males varied from one to nine individuals per month (average = 3.08 ± 2.47 captures). We captured adult females in nine months of the year (average capture = 1.08 ± 1.09), and they were absent from June to August (Tab. I). During the samplings, 19 adults were recaptured throughout the year (15 males and 4 females, Tab. I). In the first two hours after sunset (i.e., 6:00 p.m. and 7:00 p.m.) we captured 72% (N = 36) of the bats recorded throughout the year. During their exit from the roost, the average height of capture in relation to the ground was 1.9 m (SE ± 0.67). Frequency of captures decreased four hours after the beginning of the activity. The animals started returning (i.e., 19 recaptures) to the roost 2 h after the beginning of the activity. While they returned to the roost, the average capture height in relation to the ground was 4.29 m (SE ± 0.56).

We captured male bats with scrotal testes in July, August, September, and November; there was one female with a palpable fetus in September, and two females were observed nursing in April (Tab. I). Four pups were recorded inside the roost (one male in February and three females in April) and juveniles were captured with mist nets in February (one male), March (two male and one female) and May (three females) (Tab. I).

The values obtained from the external measurements of captured adults, juveniles, and pups (i.e., male and female) are described in Table II. Adult males and females did not differ from each another in body length ($t = 1.748$, $P = 0.087$) and in forearm length ($t = 0.839$, $P = 0.40$). However, adult males were heavier than females ($t = 60.83$, $P = 0.001$).

Behavior of bats inside the roost. We performed visual inspections inside the roost in six occasions (i.e., bimonthly from March 2005 to February 2006), and three

Tab. I. Number of individuals of *Eumops perotis* (Schinz, 1821) (i.e., adults, juveniles, and pups) captured (and recaptured) and their reproductive conditions over twelve months in an artificial roost in the municipality of Pindorama, state of São Paulo, southeastern Brazil. (*) refers to two females observed inside the roost.

Months	Capture (Recapture)				Puppies		Reproductive condition				
	Males		Females				Males		Females		
	Adults	Juveniles	Adults	Juveniles	Males	Female	Inactive	Reproductive	Inactive	Pregnant	Nursing
MAR	2 (2)	2	0 (0)	1	0	0	6	0	2	0	0
APR	2 (1)	0	1 (0)	0	0	3	2	0	1	0	2*
MAY	2 (0)	0	1 (1)	3	0	0	2	0	7	0	0
JUN	2 (0)	0	0 (0)	0	0	0	2	0	0	0	0
JUL	2 (0)	0	0 (0)	0	0	0	0	2	0	0	0
AUG	2 (1)	0	0 (0)	0	0	0	0	2	0	0	0
SEP	1 (2)	0	1 (0)	0	0	0	0	1	0	1	0
OCT	1 (0)	0	1 (1)	0	0	0	1	0	1	0	0
NOV	1 (0)	0	1 (1)	0	0	0	0	1	1	0	0
DEC	5 (3)	0	2 (0)	0	0	0	5	0	2	0	0
JAN	9 (4)	0	1 (0)	0	0	0	9	0	1	0	0
FEB	5 (2)	1	1 (1)	0	1	0	7	0	1	0	0

Tab. II. Body length, forearm length, and body weight of adults and juveniles of *Eumops perotis* (Schinz, 1821) (i.e., males and females). Mean, standard error, sample size are followed by intervals. *Only one individual captured.

	Adults		Juveniles		Puppies	
	Males	Females	Males	Females	Male*	Females
Body (mm)	91.94 ± 0.90, 34 71.9 to 103	85.41 ± 1.67, 9 75 to 99.8	80.13 ± 4.28, 3 69 to 86.2	80.65 ± 1.82, 4 77 to 85.9	51, 1	56.33 ± 1.22, 3 54 to 60
Forearm (mm)	77.02 ± 0.22, 34 71.7 to 82.7	75.43 ± 1.74, 9 62.3 to 81.7	59.43 ± 0.74, 3 58.3 to 68.3	63.05 ± 0.91, 4 61.7 to 66.7	2.2, 1	2.56 ± 0.14, 3 2.3 to 3
Weight (g)	70.56 ± 0.12, 34 69 to 72	51.38 ± 0.18, 8 50 to 52	69.67 ± 0.89, 3 69 to 72	50.25 ± 0.18, 4 50 to 51	1.5, 1	1.56 ± 0.11, 3 1.3 to 1.9

to seven individuals were observed in different places of the roost. In February, we observed a colony formed by seven bats, which were perched on the upper part of the attic, on the eastern wall of the roost. Five of those bats were perched side-by-side, hanging by their feet, with their venter touching the wall, and sometimes leaning on the wall with their thumbs. Two individuals, however, were overlapped on the others (Fig. 1). They were leaning on the other bats using their thumbs and they sometimes kept their venters in contact with the dorsum of the others, although these two individuals were clinging to the wall with their feet. In other months, a different number of bats used the roost: three adults in April, 2005, five in June, 2005, and six in December, 2005. They roosted horizontally in small crevices, between the upper part of the wall and the roof. These groups were formed by bats perching side by side, with their venters and thumbs in contact with the substrate.

We also observed male bats isolated from the groups in six occasions. These animals were perched on the western and eastern walls of the attic, hanging vertically by their feet, with their venters in contact with the substrate (Fig. 2). They sometimes inclined their body upwards, using their thumbs, positioning their heads horizontally, but still keeping their venters partially in contact with the substrate. At this point, it was possible to observe the presence of the gular gland in the thorax. Under the roof tiles that covered the roof lining, we also observed male bats isolated from the groups (i.e., N = 4 in December and N = 8 in January). These animals roosted horizontally between the roof tiles and the wooden slab (Fig. 3), showing the same posture described previously. After a few seconds, the bats moved inside the roost, and then, it was possible to observe the presence of the penis and/or gular gland in the thorax.

We also observed four hairless pups forming two types of colony. In the first group, the animals were side by side in the upper part of the attic adopting the contact posture, hanging upside down by their feet, vertically between the roof strutting beams and the eastern wall of the attic (space with approximately 2 cm, Fig. 4). In the second group, the pups were roosted horizontally in small crevices between the roof tiles and the attic wall, side by side or overlapped (Fig. 5). In both cases, they remained motionless and silent at a distance of 2 m from the adult colony.

During April, we observed two females nursing pups. The first female approached the group of pups crawling along the wall and vocalizing, and the pups, which were previously silent, also began to vocalize as the adult female approached. This calling was accompanied by ear-twitching, suggesting that females both receive and broadcast auditory signals. However, when the female arrived at the group of pups, only one pup would approach, and then, both touched each other with their muzzles, evidently using them to smell and exchange vocalizations. At this point, the other pups were silent. This behavior may have persisted for a minute or more, before the female raised her folded wing and nudged the pup toward one of her tits. The pup remained suckling for six minutes, and then, grabbed the other tit, suckling for another five minutes. When the pup finished suckling, the adult female licked the muzzle of pup and it returned to the nesting of pups. When the second female approached the group of pups, another pup approached and both female and pup touched each other with their muzzles. Soon after this contact, the second female started nursing the second pup.

Bat guano examination. We collected an average of 53.5 ± 3.27 g of feces per inspection. After analyzing two-month samples, we identified coleopterans, orthopterans, and lepidopterans in the feces in each of the six inspection events. During rainy season, 75% of the samples contained coleopterans, 20% contained orthopterans, and 5% contained lepidopterans. During dry season, coleopterans were found in 95% of samples and orthopterans in 5%.

DISCUSSION

In the roost studied, *E. perotis* formed a small heterosexual colony. Although we sampled 50 individuals throughout the year, we only recorded up to seven individuals using the roost at the same time and captured, on average, four individuals per month. These results corroborate previous findings (Grinnell, 1933) that reported small groups comprised of 15 to 20 individuals (Cockrum, 1960; Cox, 1965), not exceeding 100 individuals (Barbour & Davis, 1969). During part of the dry season, we only captured males leaving the roost with the mist nets, whereas individuals of both sexes were captured in all months of the rainy season. These results disagree with those obtained by Ohlendorf (1972), who reported the permanence of both sexes in the roost throughout the year. However, other studies on molossid bats and even on bats of other families reported the permanence of males throughout the year, whereas females are more frequent in the reproductive season (Esbérard, 2002). Fleming (1988) proposed that the permanence of males during the period of reproductive inactivity might be a strategy to prevent invasion by other males. This strategy can provide advantages, such as the possibility of harem formation during the reproductive season and keeping roosts closer to food sources (Morrison, 1978). The permanence of males throughout the year was also observed in the following species: *Molossops temminckii* (Burmeister, 1854), *Molossus rufus* É. Geoffroy Saint-Hilaire, 1805 (Molossidae), *Sturnira lilium* (É. Geoffroy, 1810), *Artibeus planirostris* (Spix, 1823) (Phyllostomidae) also in the state of São Paulo (Breviglieri & Uieda, 2014), and in *M. rufus* in the state of Rio de Janeiro (Esbérard, 2002). This behavior was also recorded in *A. jamaicensis* Leach, 1821 in Panama (Morrison & Handley, 1991) and *Desmodus rotundus* (É. Geoffroy, 1810) in Costa Rica (Turner, 1975). Moreover, the characteristics of the region can also favor the presence of males during dry season. The landscape adjacent to the roost is primarily comprised of pastures, sugarcane crops, and urban areas. Hence, the availability of natural roosts (e.g., hollow trees and rock crevices) is low, which makes some species dependent on attics and other artificial structures and probably increases the competition for roosting sites. In the case of the studied colony, it is possible that *E. perotis*

Figs 1-5. Different postures adopted by bats of the species *Eumops perotis* inside the roost in northwestern São Paulo, Brazil. We highlight a group of seven overlapping individuals (Fig. 1), the posture adopted by solitary males (Figs 2 and 3), and the position adopted by pups in the maternity colony (Figs 4 and 5) inside the refuge.

males remain inside the roost throughout the year due to the scarcity of roosts in the region. Consequently, we believe that territorial males can inhibit the presence of females in periods of food shortage, as described inother species (e.g., *Carollia perspicillata* (Linnaeus, 1758), *Desmodus rotundus*, *Phyllostomus hastatus* (Pallas, 1767) -Phyllostomidae, *Saccopteryx bilineata* (Temminck, 1838) - Emballonuridae, see details in Storz *et al*., 2000). However, this hypothesis should be tested in future studies.

Regarding the number of captures, there was a continuous decrease in the number of captures with mist nets between the first and fifth nights of capture in each month. Three reasons may explain this result: (i) there may have been a net shyness effect, which results in roost changes by the bats in the night after the capture. Thus, bats of this species might also be able to memorize the location of the nets and avoid sites where they have already been captured (Kurta & Kunz, 1988; Simmons & Voss, 1998; Esbérard, 2006; Robbins *et al*., 2008). Therefore, we believe that the (ii) capture effectiveness of mist nets decreases as bats learned the positions of the nets and (iii) the distress calls emitted during these events may also have influenced the success of bat capture (and recapture) throughout the samplings. We know that bat species of the family Molossidae are particularly difficult to capture because of their flight at high altitudes (McCracken *et al*., 2008) and that distress calls within or in proximity to the day-roost are probably perceived as a greater threat (Eckenweber & Knörnschild, 2016) and, consequently, can affect the activity of animals. Thus, we suggest that future studies use playbacks of social calls (i.e., acoustic lure) to increase capture success. The effectiveness of this method to capture the high-flying molossid (*Eumops floridanus* G. M. Allen, 1932, see detail in Braun De Torrez *et al*., 2017) has recently been proven.

Males in the reproductive phase, pregnant females between July and November, and females nursing pups inside the roost between February and April suggest monoestry of this species at the study site. According to Carter (1970), bats of the genus *Eumops* are polyestrous and monotocous. In North America, *E. perotis* reproduces in the beginning of spring, but pregnant females have also been recorded in summer (Barbour & Davis, 1969; Myers & Wetzel, 1983; Best *et al*., 1996). In Brazil, the only record of reproductive activity is the capture of male bats with scrotal testes during winter in the state of Rio de Janeiro (Peracchi & Albuquerque, 1971), the same pattern found in this study. Although most molossid bats are polyestrous, species of this family generally show monoestrous and polyestrous strategies, depending on location and different climate conditions (Krutzsch, 2000). Thus, we believe that this bat species also exhibits this plasticity. Unfortunately, knowledge of the biology of *E. perotis* is still poor and fragmented in Brazil and, therefore, this hypothesis must be further investigated comparing different locations in the Brazilian territory.

Our observations inside the roost suggest that all individuals (i.e., adults, juveniles, and pups) showed the contact posture, regardless of age and neighboring individuals. This behavior was observed in colonies dwelling in rock crevices in California (Vaughan, 1959) and Arizona (Cox, 1965). The animals observed in the present study were classified as anthropophilous because they used an artificial structure as a roost. They also had preference for roosting inside structures with one or more exits, and minimal direct influence from the outside environment. Roosting inside cavities with more than one access is beneficial, as these pathways can serve as escape routes when predators, such as snakes and opossums, enter the roost (Breviglieri & Uieda, 2014). The colony observed was homospecific. However, *E. perotis* can share the roost with species of the genera *Myotis* (Walton & Kimbrough, 1970), *Lasiurus*, *Tadarida*, *Nyctinomops* (Easterla, 1970), and *Glossophaga* (Polaco *et al*., 1992).

We also observed that this bat species forms maternity colonies. Each female nursed a pup at a time and the communication between them seemed to be deliberate. This behavior was similar to that observed in Mexican free-tailed bats [i.e., *Tadarida brasiliensis* (I. Geoffroy, 1824), see details in McCracken & Gustin (1991)]. Thus, the low number of pups found in the colony of *E. perotis* may favor parental care, since large maternity colonies may cause confusion in the identification of pups (McCracken & Gustin, 1991). Therefore, future studies could compare the survival rate of pups between colonies with different numbers of individuals.

We noticed that, seconds before the bats emerged from the roost, the colony started an intense vocalization activity. This vocalization was emitted not only by the individuals that flew away, but also by those that remained inside the roost. When they launched themselves from the top of the attic, bats opened their wings after falling approximately 2 m, and then, bent their bodies rapidly upward with open wings, and started flapping them and gradually gaining height. This species needs to fall at least 2 m to take off (Vaughan, 1959). Therefore, it has preference for roosts with higher entrances, as observed by Krutzsch (1955) and Vaughan (1959). According to these authors, when bats launched themselves from the cavities on rock crevices in California, they dived 3 to 7 m before stabilizing their flight. However, when bats emerged from sites where there is little space for diving or with obstacles, they opened their wings straight away and strongly bent their body upwards (Krutzsch, 1955). We observed the same behavior in the present study, which is probably related to flight capacity. In addition, during the release of the animals we observed that *E. perotis* could not take off directly from the ground or when diving 1 m or less before takeoff, which corroborates the findings by Krutzsch (1955) and Vaughan (1959).

Insectivorous bats synchronize their daily activity with that of their prey; therefore, they save energy and optimize their foraging success (Taylor & O'Neill, 1988). Hence, several bat species start their activities at sunset (Laborda & Cartwright, 1993; Esbérard, 2002), as insect activity is usually higher during this period (Provost, 1959). There are many factors that influence the activity budget

of insectivorous bats, such as prey availability (Laval & Laval, 1980), selection of the first insect detected based on palatability (Jones & Rydell, 2003), or the amount of prey items that need to be ingested, which depends on body mass (Esbérard & Bergallo, 2005).

In the feces collected inside the roost, we identified insects of the orders Coleoptera, Orthoptera, and Lepidoptera. In both seasons, coleopterans were the most consumed prey, probably because the matrix surrounding the roost is comprised mainly of pastures. According to Mendes & Linhares (2006), pastures show a dominance of coleopterans probably due to the associations of these insects with cattle feces. A higher consumption of Orthoptera and Lepidoptera is likely related to an increase in their density during rainy season (Wolda, 1988; Pinheiro *et al*., 2002). However, artificial lights attract insects and might have favored diet diversification in this species at the study site (Goldsmith, 1970; Schnitzler *et al*., 1987; Barak & Yom-Tov, 1989; Rydell & Racey, 1995; Clements, 1999). Hence, *E. perotis* might have maximized its activity in the early hours of the night by benefiting from the higher abundance of insects attracted by artificial light in this period.

In summary, it appears that the structuring of the colony of *E. perotis* is similar to that adopted by other Molossidae species (e.g., *T. brasiliensis*). Inside the roost the animals form groups comprised of males and females; however, there were also isolated males (i.e., solitary males) and maternity colonies. The observation that one pup started the movement towards the female while the others remained stationary and in silence may indicate mutual recognition. We have also shown data on morphological characteristics of the individuals comprising the colony (e.g., sex ratio, age range, reproductive status) and a broad description of the items consumed by these bats over one year. This information contributes to increase the knowledge of the natural history of this species in the Neotropical region.

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