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***Hesperoctenes fumarius* (Hemiptera: Polyctenidae) Infesting *Molossus rufus* (Chiroptera: Molossidae) in Southeastern Brazil**

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ABSTRACT: We analyzed the prevalence, intensity, and medium density of parasitism of *Hesperoctenes fumarius* infesting *Molossus rufus* in natural (hollow trees) and anthropogenic roosts (attics) in southeastern Brazil. The prevalence and intensity of infestations were higher in the hollow trees than in the attic roosts. We also noted a relationship between the amount of space available within the roost and the infestation levels of *H. fumarius*. One advantage of roosting in larger, often man-made, refuges may be the reduction in ectoparasite infestations.

Polyctenid bugs, or “batbugs” (Hemiptera: Polyctenidae), are blood-sucking ectoparasites of bats, commonly associated with the Molossidae in the Neotropics (Marshall, 1991). In southeastern Brazil, these ectoparasites are commonly collected from the pelage of *Molossus rufus* (E. Geoffroy, 1805), a medium-sized (33 g), insectivorous bat that frequently uses roofs and attics of houses and buildings as roosts (Marques, 1986; Fenton et al., 1998; Esbérard, 2002). This bat species prefers roosts where the temperature is elevated, usually by a combination of factors including the general insolation of the roost, the number and density of bats, and the decomposition of feces and urine. The colonies of *M. rufus* are large, often exceeding 500 individuals (Marques, 1986), but numbers vary through time, depending on reproduction, immigra-

tion, and emigration (Esbérard, 2002). In natural conditions, these bats often roost in hollow trees, and Esbérard et al. (2003) observed that individuals commonly returned to the same roost through 4 reproductive seasons. However, roost fidelity may have costs, i.e., long-term use of the same roosts may increase the probability of heavy parasite burdens (Lewis, 1995). In this article, we examine the parasitism of a polyctenid bug, *Hesperoctenes fumarius*, associated with the molossid bat, *M. rufus*, by comparing the infestation levels of natural and anthropogenic roosts in southeastern Brazil.

We sampled populations of polyctenid bugs infesting *M. rufus* in 3 roosts in southeastern Brazil, Rio de Janeiro State. Two were natural roosts, and the third was anthropogenic. Roost no. 1 was in a hollow “pau-d’alho” tree (*Agonandra brasiliensis*, Olacaceae), extending from a point 0.4 m from ground level to a height of 3.2 m, with roost space estimated at 3 m³ and access from above; this roost was located in the Fazenda Ventania, Municipality of Casimiro de Abreu (22°33’13.98”S, 42°00’35.82”W). Roost no. 2 was also in a hollow pau-d’alho tree, extending from the level of the ground to a height of 2.2 m, with a roost

TABLE I. Data of the collections, number of bats, number of positive bats, and total ectoparasites (*Hesperoctenes fumarius*) collected in the 3 roosts in the State of Rio de Janeiro, southeastern Brazil.

Roost nos.	Date	Size of colony	Positive bats	Number of ectoparasites
1	24 May 2003	34	26	98
1	06 September 2003	60	32	84
2	11 November 2000	29	10	10
2	24 March 2001	59	19	35
2	28 April 2001	26	11	11
2	21 July 2001	37	32	47
2	29 September 2001	14	2	4
2	02 November 2001	39	19	42
3	13 January 2001	68	7	7
3	17 March 2001	92	5	6
3	21 April 2001	64	4	4
3	02 June 2001	57	3	3
3	25 July 2001	23	2	2
3	20 October 2001	57	9	15
3	02 November 2001	113	11	19

FIGURE 1. Frequency of *Hesperoctenes fumarius* on *Molossus rufus* in 3 refuges sampled in southeastern Brazil.

FIGURE 2. Parasitism of *Hesperoctenes fumarius* on *Molossus rufus* in southeastern Brazil. **A.** Refuge in a hollow tree of 4 m³. **B.** Refuge in a hollow tree with 3 m³. **C.** Attic of house.

space estimated at 4 m³, with access from above; it was located in the Fazenda da Barra, Municipality of Casimiro de Abreu (22°33'03.3"S, 42°03'02"W). Roost no. 3 was an enclosed space under the slate-roof of a building, with a roost area estimated at 30 m³; there were large areas of empty space and 3 entrances by holes in the wall, located in the Biological Reserve of Poço das Antas, Municipality of Silva Jardim (22°33'39.2" S, 42°16'19.3"W). In all 3 roosts, *M. rufus* shared space

FIGURE 3. Variation of available space per bat (m³) and the number of bats and the number of ectoparasites collected in 2 of the roosts sampled in southeastern Brazil. The circles represent the sample from the hollow tree (roost no. 1) and the crosses the collection from the attic of a house (roost no. 3).

with another bat, the large phyllostomid, *Phyllostomus hastatus*; parasitism with *H. fumarius* was never observed in these cohabiting bats.

Each roost was sampled for 2–7 nights using mist nets opened all night next to the entrances or in the case of the anthropogenic roost, modified Davis traps (Esbérard, 2002, 2003). Captured bats were individually marked with plastic collars provided with colored beads following an established code (see Esbérard and Daemon, 1999). The bats were examined carefully; all batbugs were removed with forceps and preserved in vials of 70% ethanol. After marking and sampling for ectoparasites, the bats were released at the point of capture.

We analyzed the prevalence (proportion of bat individuals infested), the intensity of infestation (mean number of batbugs sampled per host sample or the total colony), and medium density of parasitism (mean number of batbugs per infested host sample) (Margolis et al., 1982). The prevalence, intensity, and medium density of the 3 roosts were compared with an analysis of variance realized through SYSTAT 7.0. The aggregation of parasites was calculated by the formula $k = m^2/(s^2 - m)$, where s = variance and m = mean of parasites per host. This index indicates whether the distribution of the parasite tends to be random ($k > 20$) or aggregated ($k = 1$) (Wilson et al., 2002).

Molossus rufus was captured 762 times and found positive for *H. fumarius* on 161 occasions (21%), with a total of 387 batbug ectoparasites collected (Table 1). The number of ectoparasites per bat varied from 1 to 27, with a medium of 2.22 ± 2.86 and mode of 1 ectoparasite per bat (52.5%). Three samples displayed elevated infestations (more than 15 ectoparasites per bat), corresponding to 16.2% of the ectoparasites collected ($k = 0.0068$), demonstrating that this parasite displays an aggregated distribution (Fig. 1).

The prevalence showed variation among the 3 roosts analyzed, the 2 hollow trees (roosts nos. 1 and 2) were represented by mean prevalences ($48.54 \pm 23.67\%$) higher than the attic (roost no. 3) ($8.78\% \pm 3.70$) ($F_{2,12} = 12.07$, $P = 0.001$). The prevalence differed between roost nos. 1 and 3 ($P = 0.003$) and roost no. 2 with no. 3 ($P = 0.008$) (Fig. 2). The intensity presented a similar pattern, with the hollow trees presenting values higher (1.035 ± 0.863) than the attic (0.115 ± 0.076) ($F_{2,12} = 19.48$, $P < 0.001$). Only roost nos. 2 and 3 did not differ significantly ($P = 0.074$) (Fig. 2). The medium density varied ($F_{2,12} = 13.80$, $P = 0.001$) among the 3 roosts considered, although roost nos.

2 and 3 did not differ significantly ($P = 0.382$) (Fig. 2). Of the 2 most sampled roosts, a clear relationship was observed between the space available for the bats (roost space) and the number of ectoparasitic batbugs collected (Fig. 3).

The size of the bat colony varies seasonally, with largest concentrations observed during the reproductive season (Esbérard, 2002). Less roost space imposes higher contact between the bats and, consequently, increases the probability of parasitism. Larger spaces may permit, and even maintain, more plentiful colonies and can result in dilution of the number of ectoparasites infesting the colony. The use of anthropogenic roosts, generally with larger amounts of available roost space, is shown to have advantages in avoiding parasitism. Also, living in an urban area often provides an elevated availability of prey for insectivorous bats because insects are attracted to artificial illumination. *Molossus rufus* is a common bat in urban areas of southeastern Brazil and frequently roosts in roofs and attics of houses and buildings (Esbérard et al., 1999). Various species change localities to avoid parasites (Lewis, 1995). This bat uses the refuge for short periods of time, being sited 3 mo of each year (Esbérard, 2002), and this can be a strategy to limit the chance of elevated infestation by parasites.

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