Ectoparasitic Mites (Acari) of Sympatric Brazilian Free-Tailed Bats and Big Brown Bats in Alabama

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J. Med. Entomol. 29(3): 507–511 (1992)

ABSTRACT Seven species of mites were recovered from 133 Brazilian free-tailed bats, *Tadarida brasiliensis*, and 94 big brown bats, *Eptesicus fuscus*, from February through November 1990 in colonies that shared roosting space in east-central Alabama. The macronyssid *Chiroptonyssus robustipes* (Ewing) was the most common mite on *T. brasiliensis* (964 mites, 87% of bats infested) and on *E. fuscus* (109 mites, 29% of bats infested). However, *C. robustipes* normally is a specific parasite of *T. brasiliensis*. The macronyssids *Steatonyssus ceratognathus* (Ewing) and *S. occidentalis* (Ewing) were recovered from both species of bats in low numbers. *S. ceratognathus* is not a typical parasite of either species of bat, but *S. occidentalis* normally is specific to *E. fuscus*. Predictably, *S. occidentalis* was most frequently collected from *E. fuscus* (16 mites, 9% of bats infested), but two specimens were recovered from *T. brasiliensis*. Five specimens of the laelapid *Androlaelaps casalis* (Berlese) (a mite that is frequently associated with rodents) and one specimen of the myobiid mite *Ewingana* (*Doreyana*) *longa* (Ewing) (a specific ectoparasite of *T. brasiliensis*) were also recovered from *T. brasiliensis*. Singletons of the rosensteiniids *Mydopholeus* sp. and *Nycteriglyphites pennsylvanicus* Fain, Lukoschus & Whitaker were the only additional mites collected from *E. fuscus;* both of these mites have previously been collected from bats or their guano but are recorded here from Alabama for the first time. With respect to ectoparasite cross-infestations, *E. fuscus* appears to be at greater risk from sharing roosts with *T. brasiliensis*. This is highlighted by the comparatively large numbers of *C. robustipes* that occurred on *E. fuscus* and the low numbers of *S. occidentalis* on *T. brasiliensis*. Although mites were the only arthropods recovered from bats in this study, a separate survey in 1991 revealed that the bat bug *Cimex adjunctus* Barber infested some other colonies of *T. brasiliensis* and *E. fuscus* in Alabama.

KEY WORDS Arachnida, Acari, ectoparasites, bats

WHEN TWO OR MORE species of mammals share the same microhabitat, the ectoparasitic arthropods associated with each species may have the opportunity to parasitize the other mammalian species. However, numerous species of ectoparasites are considered to be host specific. An opportunity to investigate these phenomena arose when colonies of two species of bats, belonging to different families, were found to occupy the same attic space in a large building in east-central Alabama. In this case, the Brazilian free-tailed bat, *Tadarida brasiliensis* (I. Geoffroy) (family Molossidae), occurred with the big brown bat, *Eptesicus fuscus* (Palisot de Beauvois) (family Vespertilionidae). Sympatry was extreme because hundreds of bats of each species shared the attic, and roosting groups often were intermingled so that individual bats of different species sometimes were in direct physical contact.

Both *T. brasiliensis* and *E. fuscus* have wide geographic ranges, and the ectoparasitic mite faunas associated with each of them are well known for several regions. *T. brasiliensis* ranges from the southern and western United States through Central America and the Caribbean region to South America as far south as Chile and Argentina (Wilkins 1989). The geographic range of *E. fuscus* includes most of North America (as far north as central Canada), Central America, the Caribbean, and South America as far south as Colombia and Venezuela (Kurta & Baker 1990). Publications that discuss ectoparasitic mites from both species are by Radovsky & Furman (1963) and Radovsky (1967) for the entire ranges of these bats, Whitaker & Wilson (1974) for North America north of Mexico, Bradshaw & Ross (1961) for Arizona, Whitaker & Easterla (1975) for Texas, Dooley et al. (1976) for Texas and New Mexico, Tyndal (1951) for Alabama and Tennessee, and White (1959) for Alabama. Additional studies that consider mites from *T. brasiliensis* are by Pence et al. (1981) for the Caribbean island of Dominica, and Hays & Guyton (1958) for Alabama. Whitaker & Wilson (1974) recorded 11

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species of mites (excluding chiggers), representing six families, to infest *T. brasiliensis* in North America, and White (1959) reported six species representing four families of mites from this bat in Alabama. Additional studies that document ectoparasitic mites from *E. fuscus* include those by Mitchell & Hitchcock (1965) for Maryland, Miller et al. (1973) for Pennsylvania, Whitaker (1973, 1982) for Indiana, Dood & Kurta (1982, 1988) for Michigan, Whitaker et al. (1983) for Oregon, and Brennan & White (1960) for Alabama. Whitaker & Wilson (1974) recorded 15 species of mites (excluding chiggers), representing five families, to infest *E. fuscus* in North America. White (1959) reported 10 species of mites in five families from *E. fuscus* in Alabama. Commonly encountered mites on *T. brasiliensis* are the macronyssid *Chiroptonyssus robustipes* (Ewing) and the myobiids *Ewingana* (*Doreyana*) *inequalis* (Ewing) and *E.* (*D.*) *longa* (Ewing). Mites frequently reported from *E. fuscus* include the macronyssids *Cryptonyssus desultorius* Radovsky, *Macronyssus crosbyi* (Ewing & Stover), and *Steatonyssus occidentalis* (Ewing); the myobiid *Acanthophthirius caudatus eptesicus* (Fain & Whitaker); and the spinturnicid *Spinturnix bakeri* Rudnick.

Although mites were the only arthropods found on bats during this study, further surveys by C.D.H. during 1991 revealed the presence of the cimicid bat bug *Cimex adjunctus* Barber in two bat colonies in residential houses in Auburn, Ala. At one locality, 10 *C. adjunctus* (seven males, three females) were collected from a pool of 15 *E fuscus;* bat bugs were also observed crawling in the roost and on bat guano at this site. At the other locality, two *C. adjunctus* (one male, one female) were recovered from a pool of 11 *E. fuscus* and 1 *T. brasiliensis*. Usinger (1966) recorded *C. adjunctus* from the evening bat, *Nycticeius humeralis* (Rafinesque) in Auburn, Ala., and Tyndal (1951) reported *Cimex pilosellus* (Horvath) from *E. fuscus* in Tuscaloosa, Ala. The latter record probably represents a misidentification (*C. pilosellus* typically occurs in western North America) because *C. pilosellus* was the only bat bug included in the cimicid identification key used by Tyndal (1951), and all such ectoparasites would therefere have keyed to that species.

Materials and Methods

Bats were captured by hand from roosting sites in the attic of Samford Hall, a large, old building on the campus of Auburn University, Auburn, Lee County, Ala. Bat colonies were sampled just after dusk, once per month from February through November 1990. Each bat was identified, and its sex was determined; then it was placed individually in a paper bag and euthanized with chloroform. Ectoparasites were then collected from the fur of each bat by meticulous pelage searches (aided by a dissecting microscope) and combined with any arthropods recovered from the corresponding paper bags. Collected arthropods were stored in ethanol before they were identified. Most *C. robustipes* mites could be identified using a 60× binocular microscope as uncleared specimens, but other mites were cleared in lactophenol and slide-mounted in Hoyer's medium for examination with a high-power compound microscope. Voucher arthropods from this study are deposited in the Auburn University Insect Museum, and bats are stored in the Zoological Museum of the same University.

Results

Mites were the only arthropods found on the bats examined during this study. Table 1 shows that the macronyssid mite *C. robustipes* was the dominant species recovered from *T. brasiliensis*. This species accounted for 964 of the 987 mites collected from *T. brasiliensis* and was present on 87% of the bats examined. Monthly infestation data for *C. robustipes* on this species of bat are presented graphically in Fig. 1. Other species of mites that were recovered from *T. brasiliensis* had low infestation intensities (mean number of mites per infested bat) and infested few bats. *Steatonyssus ceratognathus* (Ewing) was the next most common species of mite, with 15 specimens collected.

Table 1 shows that *C. robustipes* also was the most frequently collected mite from *E. fuscus* in this study, accounting for 109 of 130 mites recovered. However, overall infestation prevalence (percent infested) (29%) was much lower, and mean intensity was less than one-half that recorded for *T. brasiliensis*. Except for *S. occidentalis* (16 specimens), other species of mites collected from *E. fuscus* were present in small numbers.

Discussion

Most of the mites collected in this survey are associated with one or both of the species of bats examined. The only exception was *Androlaelaps casalis* (Berlese), which frequently parasitizes various species of rodents. This mite previously has not been reported from bats in North America north of Mexico (Whitaker & Wilson 1974) but was recorded from a roost of *Plecotus aurita* L. bats in England by Woodroffe (1956). *A. casalis* is a generalized feeder with relatively unspecialized mouthparts (Wharton & Cross 1957, Hughes 1976), and it has been recorded to bite humans (Baker et al. 1956).

Although each species was represented by just one specimen, the myobiid and rosensteiniid mites collected during this survey are noteworthy. According to Dusbábek (1969), the myobiid

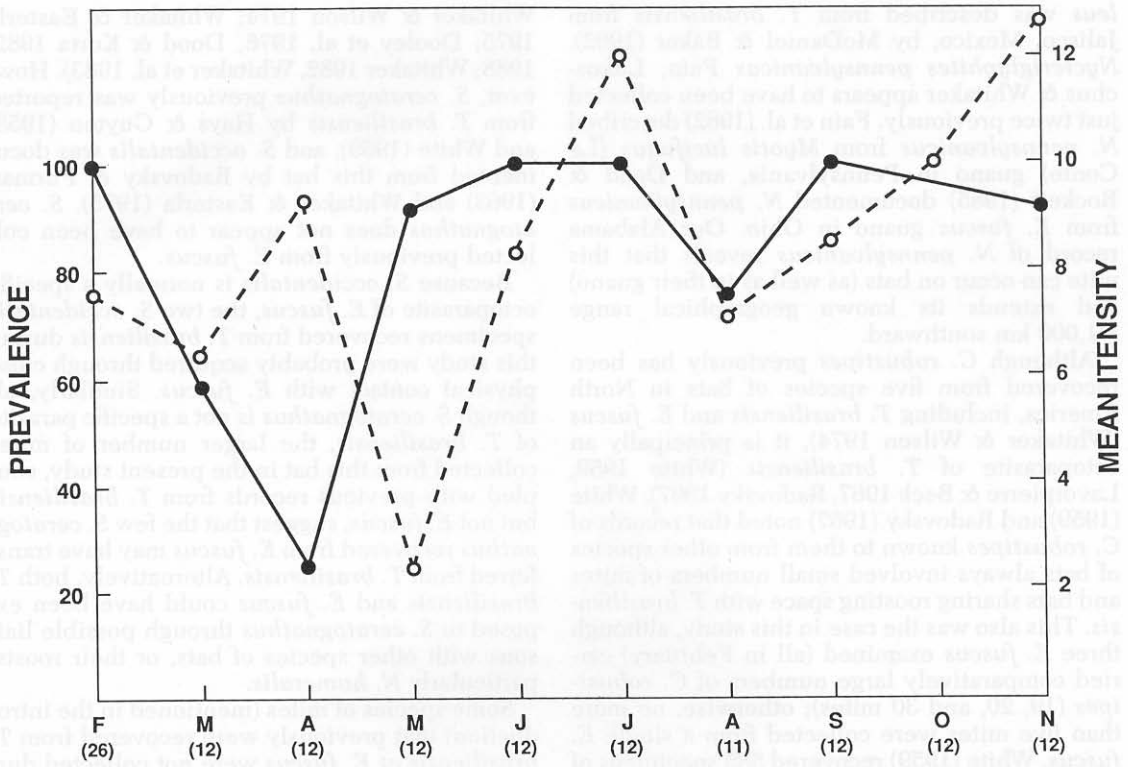

Fig. 1. Prevalence (percentage infested) (solid line) and mean intensity (mean per infested host) (broken line) of *C. robustipes* parasitizing Brazilian free-tailed bats, *Tadarida brasiliensis*, in Auburn, Ala., February–November 1990. The number of bats included in each monthly sample is given in parentheses.

E. (D.) inequalis occurs on *T. brasiliensis cynocephala* whereas *E. (D.) longa* parasitizes *T. b. mexicana*. Wilkins (1989) states that *T. b. cynocephala* is the subspecies of this bat that is found in Alabama. However, we collected *E. (D.) longa* from *T. brasiliensis* in Alabama, as did White (1959), so apparently both species of *Ewingana* can infest *T. b. cynocephala*.

Most species of rosensteiniids have been described from bat guano, but a few specimens were collected from bats. These mites probably feed on bat guano and its associated microorganisms or possibly on sloughed skin scales, etc. from bats; apparently they are not parasitic. Both rosensteiniids collected in this survey represent new records for Alabama. The genus *Mydopho-*

Table 1. Infestation parameters for mites recovered from 133 Brazilian free-tailed bats, *T. brasiliensis* (73 males, 60 females), and 94 big brown bats, *E. fuscus* (30 males, 64 females), in Auburn, Ala., February–November 1990

Mite species	*Tadarida brasiliensis*				*Eptesicus fuscus*			
	% Prevalence	Mean intensity	Infestation range	No. collected[a]	% Prevalence	Mean intensity	Infestation range	No. collected[a]
Laelapidae								
Androlaelaps casalis	1 (1,0)	5.0 (5.0,0)	5	1M,4N	—	—	—	—
Macronyssidae								
Chiroptonyssus robustipes	87 (86,87)	8.4 (8.3,8.6)	1–31	13M,93F,858N	29 (23,31)	4.0 (5.9,3.4)	1–30	5M,16F,88N
Steatonyssus ceratognathus	6 (6,7)	1.9 (1.3,2.5)	1–5	5F,10N	1 (3,0)	3.0 (3.0,0)	3	1F,2N
Steatonyssus occidentalis	2 (0,3)	1.0 (0,1.0)	1	2F	9 (10,8)	2.0 (2.0,2.0)	1–4	1M,5F,10N
Myobiidae								
Ewingana (D.) longa	1 (1,0)	1.0 (1.0,0)	1	1F	—	—	—	—
Rosensteiniidae								
Mydopholeus sp.	—	—	—	—	1 (0,2)	1.0 (0,1.0)	1	1F
Nycteriglyphites pennsylvanicus	—	—	—	—	1 (0,2)	1.0 (0,1.0)	1	1F

Values in parentheses are for male and female hosts, respectively.
[a] M, male(s); F, female(s); N, nymph(s).

leus was described from *T. brasiliensis* from Jalisco, Mexico, by McDaniel & Baker (1962). *Nycteriglyphites pennsylvanicus* Fain, Lukoschus & Whitaker appears to have been collected just twice previously. Fain et al. (1982) described *N. pennsylvanicus* from *Myotis lucifugus* (Le Conte) guano in Pennsylvania, and Dood & Rockett (1985) documented *N. pennsylvanicus* from *E. fuscus* guano in Ohio. Our Alabama record of *N. pennsylvanicus* reveals that this mite can occur on bats (as well as in their guano) and extends its known geographical range ≈1,000 km southward.

Although *C. robustipes* previously has been recovered from five species of bats in North America, including *T. brasiliensis* and *E. fuscus* (Whitaker & Wilson 1974), it is principally an ectoparasite of *T. brasiliensis* (White 1959, Lavoipierre & Beck 1967, Radovsky 1967). White (1959) and Radovsky (1967) noted that records of *C. robustipes* known to them from other species of bats always involved small numbers of mites and bats sharing roosting space with *T. brasiliensis*. This also was the case in this study, although three *E. fuscus* examined (all in February) carried comparatively large numbers of *C. robustipes* (19, 20, and 30 mites); otherwise, no more than five mites were collected from a single *E. fuscus*. White (1959) recovered 585 specimens of *C. robustipes* from *T. brasiliensis* but only eight from *E. fuscus*, but he did not state the numbers of bats examined. Detailed studies by Lavoipierre & Beck (1967) and Radovsky (1967) clearly point to a close relationship between *C. robustipes* and *T. brasiliensis*. In view of these data, it is noteworthy that *C. robustipes* was the principal ectoparasite of both species of bats studied during this project. The lower prevalence and intensity of *C. robustipes* on *E. fuscus* suggest that these mites transferred from their typical host, *T. brasiliensis*, onto *E. fuscus*. *C. robustipes* also will attack humans (Hoffmann [1944], as *Liponyssus venezolanus* Vitzthum, an erroneous identification of *C. robustipes* according to Strandtmann & Wharton [1958], Eads et al. [1957], and Keh [1974]).

Monthly figures for *C. robustipes* infestations on *T. brasiliensis* shown graphically in Fig. 1 reveal that peaks in mean intensity (April, July, November) lagged by 1–2 mo behind peaks in prevalence (February, June–July, September–October) in all three cases. These trends may be seasonal, but this cannot be assumed with only 10 mo of collection data.

Two species of mites belonging to the genus *Steatonyssus* were collected from both species of bats. *Steatonyssus ceratognathus* (Ewing) commonly is associated with *N. humeralis* (Hays & Guyton 1958, White 1959, Radovsky & Furman 1963, Whitaker 1982), and *S. occidentalis* (Ewing) is mainly an ectoparasite of *E. fuscus* (Radovsky & Furman 1963; Miller et al. 1973; Whitaker & Wilson 1974; Whitaker & Easterla 1975; Dooley et al. 1976; Dood & Kurta 1982, 1988; Whitaker 1982, Whitaker et al. 1983). However, *S. ceratognathus* previously was reported from *T. brasiliensis* by Hays & Guyton (1958) and White (1959), and *S. occidentalis* was documented from this bat by Radovsky & Furman (1963) and Whitaker & Easterla (1975). *S. ceratognathus* does not appear to have been collected previously from *E. fuscus*.

Because *S. occidentalis* is normally a specific ectoparasite of *E. fuscus*, the two *S. occidentalis* specimens recovered from *T. brasiliensis* during this study were probably acquired through close physical contact with *E. fuscus*. Similarly, although *S. ceratognathus* is not a specific parasite of *T. brasiliensis*, the larger number of mites collected from this bat in the present study, coupled with previous records from *T. brasiliensis* but not *E. fuscus*, suggest that the few *S. ceratognathus* recovered from *E. fuscus* may have transferred from *T. brasiliensis*. Alternatively, both *T. brasiliensis* and *E. fuscus* could have been exposed to *S. ceratognathus* through possible liaisons with other species of bats, or their roosts, particularly *N. humeralis*.

Some species of mites (mentioned in the introduction) that previously were recovered from *T. brasiliensis* or *E. fuscus* were not collected during this study. Possible contrasting geographic distributions for these mites, or different methods of ectoparasite recovery, may explain these differences.

In summary, from the perspective of ectoparasite cross-infestations, *E. fuscus* appears to be at greater risk from sharing roosts with *T. brasiliensis*. Most of the mites recovered from *E. fuscus* were *C. robustipes* (109 specimens on 94 bats examined), a mite that typically lives in association with *T. brasiliensis*. Contrastingly, only two specimens of *S. occidentalis*, a specific ectoparasite of *E. fuscus*, were recovered from 133 *T. brasiliensis*.

Acknowledgment

Numerous persons assisted in the collection of specimens. We especially thank J. Bartig, S. Burt, K. Caesar, and H. Henry. Earlier drafts of this manuscript were reviewed by G. W. Korch, Jr., K. J. Linthicum, R. S. Lishak, G. R. Mullen, and C. Sundermann. This is journal article 15–913085 of the Alabama Agricultural Experiment Station.

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Received for publication 20 September 1991; accepted 9 December 1991.