University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Faculty Publications from the Harold W. Manter
Laboratory of Parasitology

Parasitology, Harold W. Manter Laboratory of

4-1988

***Eimeria* from Bats of the World. II. A New Species in *Tadarida femorosacca* from Sonora, Mexico**

Donald W. Duszynski

University of New Mexico, eimeria@unm.edu

David W. Reduker

Washington State University

Brent B. Parker

Colorado State University

Follow this and additional works at: <https://digitalcommons.unl.edu/parasitologyfacpubs>

Part of the [Parasitology Commons](#)

Duszynski, Donald W.; Reduker, David W.; and Parker, Brent B., "*Eimeria* from Bats of the World. II. A New Species in *Tadarida femorosacca* from Sonora, Mexico" (1988). *Faculty Publications from the Harold W. Manter Laboratory of Parasitology*. 180.

<https://digitalcommons.unl.edu/parasitologyfacpubs/180>

This Article is brought to you for free and open access by the Parasitology, Harold W. Manter Laboratory of at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Faculty Publications from the Harold W. Manter Laboratory of Parasitology by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

EIMERIA FROM BATS OF THE WORLD. II. A NEW SPECIES IN *TADARIDA FEMOROSACCA* FROM SONORA, MEXICO

Donald W. Duszynski, David W. Reduker*, and Brent B. Parker†

Department of Biology, The University of New Mexico, Albuquerque, New Mexico 87131

ABSTRACT: Between 1979 and 1980, 104 bats representing 13 species in 4 families were collected in California and New Mexico, U.S.A., and Baja California and Sonora, Mexico, and were examined for coccidia; only 3 (3%) had oocysts in their feces. Bats examined and their infection rates were: Molossidae: 0 of 12 *Tadarida brasiliensis*, 1 of 18 (6%) *T. femorosacca*; Natalidae: 0 of 1 *Natalus stramineus*; Phyllostomatidae: 0 of 1 *Choeronycteris mexicana*, 0 of 2 *Leptonycteris sanborni*, 0 of 1 *Macrotus californicus*; Vespertilionidae: 0 of 9 *Antrozous pallidus*, 0 of 28 *Eptesicus fuscus*, 0 of 1 *Lasionycteris noctivagans*, 0 of 3 *Lasiurus borealis*, 2 of 22 (9%) *L. cinereus*, 0 of 1 *L. ega*, 0 of 5 *Pipistrellus hesperus*. Sporulated oocysts were only found in *T. femorosacca* and these represent a new species, *Eimeria tadarida* n. sp. They are subspheroidal to ellipsoidal, 19×25 ($16\text{--}23 \times 20\text{--}30$) μm ; a micropyle is absent, and fragments within the oocyst may be oocyst residuum or multiple polar bodies. The oocyst wall, ~ 1.5 μm , is composed of a mammillated outer layer and smooth inner layer. Sporocysts are ovoidal, 8×12 ($6\text{--}9 \times 10\text{--}14$) μm , and have a small Stieda body and a wide substieda body. This is only the 14th eimerian to be described from bats worldwide. Only unsporulated or partially sporulated oocysts of an eimerian were seen in 2 *L. cinereus*. These measured 28×25 ($27\text{--}29 \times 24\text{--}26$) μm and had a mammillated outer oocyst wall.

From July 1979 through December 1980 bats were collected from various localities in California and New Mexico, U.S.A., and Baja California and Sonora, Mexico; all animals were examined for the presence of coccidian oocysts in their feces. This paper summarizes our findings.

MATERIALS AND METHODS

Hosts were captured alive in mist nets and killed within a few hours after capture. Procedures for removal of intestines, preserving fecal material, and processing, measuring, and photographing oocysts were as described previously (Duszynski et al., 1982; Stout and Duszynski, 1983). Skeletons, skins, and tissues for isoenzyme analysis for all hosts are permanently deposited in the Museum of Southwestern Biology, UNM. All measurements are in μm with means ± 1 SD in parentheses following the ranges.

RESULTS

Of 104 bats representing 13 species and 4 families from 14 collection localities (Table I) only 3 had large numbers of oocysts in their feces. The study of these oocysts revealed qualitative and quantitative differences between them and oocysts of other *Eimeria* spp. described from bats.

Received 2 September 1987; revised 6 October 1987; accepted 17 December 1987.

* Present address: Department of Veterinary Microbiology and Pathology, Washington State University, Pullman, Washington 99164.

† Present address: College of Veterinary Medicine, Colorado State University, Ft. Collins, Colorado 80523.

Eimeria tadarida n. sp.

(Figs. 1–4, 8)

Description

Oocysts subspheroidal (Fig. 1) to ellipsoidal (Fig. 2), wall of uniform thickness ~ 1.5 , with 2 layers: outer layer mammillated (Fig. 3), $\sim 2/3$ of total thickness, inner layer smooth; micropyle absent; 1–3 fragments within oocyst (Fig. 4) that may represent multiple polar bodies or a dispersed oocyst residuum; sporulated oocysts ($n = 100$) $20\text{--}30 \times 16\text{--}23$ ($25.2 \pm 2.1 \times 19.0 \pm 1.2$), with L:W ratio 1.2–1.6 (1.3 ± 0.1); sporocysts ($n = 100$) ovoidal, $10\text{--}14 \times 6\text{--}9$ ($12.1 \pm 0.7 \times 7.6 \pm 0.9$), with L:W ratio 1.4–1.7 (1.6 ± 0.1); Stieda body small, difficult to see with transmitted light or interference contrast microscopy; substieda body apparently present (there is always a clear space below pointed end of sporocyst: Figs. 1, 2, 4), asymmetrical, 2–3 $\times$ wider than Stieda body; parastieda body absent; sporocyst residuum composed of several small to large globules and granules, sometimes obscuring sporozoites; sporozoites with a large, posterior refractile body. Oocysts were 1,935 days old when measured.

Taxonomic summary

Diagnosis: Of the 13 valid species of *Eimeria* previously described from chiropteran hosts (Levine and Ivens, 1981; Duszynski and Barkley, 1985), only *Eimeria tomopea* Duszynski and Barkley, 1985, *Eimeria macyi* Wheat, 1975, and *Eimeria eumopos* Marinkelle, 1968 resemble *E. tadarida*. Oocysts of *E. tadarida* differ from those of *E. tomopea* by being smaller and lacking a polar body; they also have smaller sporocysts that have a substieda body that *E. tomopea* lacks, although in both species the Stieda body is difficult to visualize. They differ from those of *E. macyi* by having a residuum and lacking polar bodies; by having larger oocysts with a larger L:W ratio (1.3 vs. 1.1); and by having a substieda body that is 2–3 $\times$ wider than the Stieda body vs. one that is the same width. They differ

TABLE I. *Thirteen species of bats representing 4 families taken from 14 collection localities from California, New Mexico, and Baja California and Sonora, Mexico and examined for coccidia.*

Chiropteran family/host	Country: County/locality, state	No. hosts infected/ no. examined (%)
Molossidae		
<i>Tadarida brasiliensis</i>	U.S.A.: Socorro Co., New Mexico	0/5
	Hidalgo Co., New Mexico	0/7
<i>T. femorosacca</i>	Mexico: Sierra San Pedro Martir, Baja	0/12
	Mission de San Borja, Baja	0/5
	Alamos, Sonora	1/1
Natalidae		
<i>Natalus stramineus</i>	Mexico: Guaymas, Sonora	0/1
Phyllostomatidae		
<i>Choeronycteris mexicana</i>	Mexico: Rancho Santa Catalina, Baja	0/1
<i>Leptonycteris sanborni</i>	Mexico: San Carlos, Sonora	0/2
<i>Macrotus californicus</i>	Mexico: San Carlos, Sonora	0/1
Vespertilionidae		
<i>Antrozous pallidus</i>	U.S.A.: Madera Co., California	0/6
	Mexico: Punta Chueca, Sonora	0/2
	Sierra San Pedro Martir, Baja	0/1
<i>Eptesicus fuscus</i>	U.S.A.: Hidalgo Co., New Mexico	0/6
	Sandoval Co., New Mexico	0/1
	Socorro Co., New Mexico	0/1
	Mexico: Sierra San Pedro Martir, Baja	0/20
<i>Lasionycteris noctivagans</i>	U.S.A.: El Dorado Co., California	0/1

TABLE I. *Continued.*

Chiropteran family/host	Country: County/locality, state	No. hosts infected/ no. examined (%)
<i>Lasiurus borealis</i>	U.S.A.: Hidalgo Co., New Mexico	0/3
<i>L. cinereus</i>	U.S.A.: El Dorado Co., California	0/3
	Hidalgo Co., New Mexico	1/8 (12.5)
	Mexico: Sierra San Pedro Martir, Baja	1/11 (9.0)
<i>L. ega</i>	Mexico: Mission de San Borja, Baja	0/1
<i>Pipistrellus hesperus</i>	Mexico: Guaymas, Sonora	0/3
	Sierra San Pedro Martir, Baja	0/1
	Valle de Trinidad, Baja	0/1
4 families, 13 species	14 localities	3/104 (1)

from those of *E. eumopos* by lacking polar bodies and being much smaller (25×19 vs. 35×28); by having a thinner outer wall that is mammillated, not pitted; and by having sporocysts with a substieda body that *E. eumopos* lacks.

Type host: *Tadarida femorosacca* (Merriam), pocketed free-tail bat, Museum of Southwestern Biology, Division of Mammals, MSB #53835 (female), J. Haydock #282, 27 October 1980.

Type locality: Mexico. Sonora: 19.3 km E Alamos by road Rio Cuckujaqui.

Site of infection: Unknown. Oocysts recovered from feces.

Etymology: The *nomen triviale* is derived from the generic name of the host.

***Eimeria* sp.** (Figs. 5–7)

Oocysts subspheroidal (Fig. 5), wall of uniform thickness ~ 2.0 , with 2 layers: outer layer mammillated (Fig. 6, insert), $\sim 3/4$ of total thickness, inner layer smooth (Fig. 6). Although no sporulated oocysts were seen, a few abnormally sporulated forms (Fig. 7) clearly show

→

FIGURES 1–7. Photomicrographs of sporulated oocysts of *Eimeria tadarida* n. sp. collected from the feces of *Tadarida femorosacca* (Figs. 1–4) and of unsporulated oocysts of an eimerian collected from the feces of *Lasiurus cinereus* (Figs. 5–7). $\times 1,600$. 1. Subspheroidal oocyst; note striated appearance of wall. 2. More ellipsoidal oocyst; note the clear area (arrows) seen in these sporocysts and in those in Figures 1 and 4, that is probably a substieda body. 3. Mammillated surface of outer oocyst wall (NIC). 4. Oocyst with what is either multiple polar bodies or fragments of a residuum (arrows). 5. Subspheroidal oocyst. 6. Outer wall separating from smooth inner wall of partially sporulated oocyst; insert shows mammillated outer layer of oocyst wall (NIC). 7. Broken, partially sporulated oocyst with what may be a parastieda body (arrow) in one of the sporocysts.

FIGURE 8. Line drawing of a sporulated oocyst of *Eimeria tadarida*. Bar = 5 μ m.

that this species is an eimerian. Unsporulated oocysts were 28×25 ($27-29 \times 24-26$) with L:W ratio 1.1.

Taxonomic summary

Diagnosis: This form is similar in either size or shape to *E. eumopos*, *E. macyi*, *E. tomoepa*, and *Eimeria zakirica* Mussev, 1967. It differs from the first 3 by being smaller than *E. eumopos* (35×28) and *E. tomoepa* (31×25) and larger than *E. macyi* (19×18). It differs from *E. eumopos* and *E. tomoepa* by being less ellipsoidal (L:W 1.1 vs. 1.2-1.4). It is similar to all 3 species, however, by having a highly sculptured outer wall that appears striated in optical cross section. Although similar in size and shape to *E. zakirica*, the 2 differ because *E. zakirica* has a thin, smooth 1-layered oocyst wall.

Type host: *Lasiurus cinereus* (Beauvois, 1796), hoary bat, Museum of Southwestern Biology, Division of Mammals, MSB #42509 (male), D. A. Goebel #38, 16 June 1980.

Type locality: U.S.A. New Mexico: Hidalgo Co., 27.3 km S, 10.6 km E, Animas.

Other host and locality: *Lasiurus cinereus*, MSB #43048 (male), T. L. Best #8622, 8 July 1980, Mexico, Baja California, Parque Nacional, Sierra de San Pedro Martirs.

DISCUSSION

The mammalian order Chiroptera is second only to the rodents in terms of species diversity and numbers. However, in contrast to rodents, few *Eimeria* spp. have been described from bat

hosts. For example, only 14 valid *Eimeria* species have been described from 14 species of bats, 1.5% of the living bat host species (see Duszynski and Barkley, 1985, for review). There are at least 2 possible explanations for this. First, as pointed out by Ubelaker et al. (1977), the paucity of *Eimeria* spp. described from bats reflects the fact that few people have examined bats for intestinal coccidia. A second explanation is that bats, as a group, seem not to be regularly parasitized by monoxenous coccidians. In the few surveys that have been done, only small numbers of bats are ever found to be discharging oocysts. For example, Marinkelle (1968) found only 2 of 400 bats (23 species) in Colombia to have oocysts in their feces when examined. Similarly, here we found only 3 of the 104 bats (13 species) we examined from Mexico and the western U.S.A. to be actively discharging oocysts. The mechanism that drives this low rate of infection simply may be the feeding habits of the hosts. Most bats (e.g., molossids, vespertilionids) are insectivores and insects on the wing do not seem to be particularly good concentrating mechanisms for oocysts. Bats that eat other things such as fruit, nectar, or pollen (e.g., phyllostomatids) do not seem to be any more often infected than insectivores, although more survey work needs to be done before this idea can be critically examined. Likewise, *Antrozous*, a bat with unusual eating habits and known to forage on the ground and eat scorpions and crickets, also is not often infected with coccidians. Thus, regardless of diet, bats have never been found to be heavily infected with coccidians. Host genetic factors (e.g., high chromosomal variability) may contribute to this phenomenon (see Duszynski, 1986). Finally, it is interesting to note that 2 *L. cinereus* collected in different localities were discharging oocysts (*Eimeria* sp., above) that probably represent the same species.

Based on characteristics of the oocyst wall (thickness and texture), Duszynski and Barkley (1985) hypothesized at least a diphyletic origin for *Eimeria* spp. infecting bats. The 3 eimerians previously described from New World vespertilionid and molossid bats (*E. macyi*, *E. tomoepa*, *E. eumopos*) have thick and mammillated oocyst walls, whereas the 6 eimerians described from African and Old World vespertilionids and molossids (*E. dukei*, *E. levinei*, *E. nyctali*, *E. vajsovi*, *E. vespertillii*, *E. zakirica*) have smooth-walled oocysts. *Eimeria tadarida* and *Eimeria* sp., which parasitize a New World molossid and

vespertilionid, respectively, both have mammillated oocyst walls, thus supporting this hypothesis.

ACKNOWLEDGMENTS

We are indebted to the following colleagues at UNM and elsewhere for their help in catching bats and in various other aspects of this work: Dr. J. Bandoli, Dr. T. L. Best, C. Bindl, A. S. Christmas, Dr. S. B. George, D. A. Goebel, Dr. D. J. Hafner, J. Haydock, Dr. C. A. Speer, Dr. C. A. Stout, and, especially, Dr. T. L. Yates. Thanks are also due L. Hertel who did the line drawing. This work was supported, in part, by the Biology Graduate Research Allocation Committee, UNM.

LITERATURE CITED

- DUSZYNSKI, D. W. 1986. Host specificity in the coccidia of small mammals: Fact or fiction? In *Advances in protozoological research*, M. Berczky (ed.), Symposia Biologica Hungarica, Vol. 33. Akademiai Kiado, Budapest, pp. 325–337.
- , AND L. J. BARKLEY. 1985. *Eimeria* from bats of the world: A new species in *Tomopeas ravis* from Peru. *Journal of Parasitology* **71**: 204–208.
- , G. EASTHAM, AND T. L. YATES. 1982. *Eimeria* from jumping mice (*Zapus* spp.): A new species and genetic and geographic features of *Z. hudsonicus luteus*. *Journal of Parasitology* **68**: 1146–1148.
- LEVINE, N. D., AND V. IVENS. 1981. The coccidian parasites (Protozoa, Apicomplexa) of bats. In *Parasitological topics: A presentational volume to P. C. C. Garnham, F.R.S., on the occasion of his 80th birthday*, E. U. Canning (ed.), Society of Protozoologists, Special Publication No. 1, pp. 170–176.
- MARINKELLE, C. J. 1968. *Eimeria eumopos* n. sp. from a California bat *Eumops trumbulli*. *Journal of Protozoology* **15**: 57–58.
- STOUT, C. A., AND D. W. DUSZYNSKI. 1983. Coccidia from kangaroo rats (*Dipodomys* spp.) in the western United States, Baja California, and northern New Mexico with descriptions of *Eimeria merriami* sp. n. and *Isospora* sp. *Journal of Parasitology* **69**: 209–214.
- UBELAKER, J. E., R. D. SPECIAN, AND D. W. DUSZYNSKI. 1977. Endoparasites. In *Biology of the New World family Phyllostomatidae*, Part II, R. J. Baker, J. K. Jones, and D. C. Carter (eds.), Special Publication No. 13 of the Museum, Texas Tech University Press, Lubbock, pp. 7–56.