DESCRIPTIONS OF TWO NEW SPECIES OF *EIMERIA* (APICOMPLEXA: EIMERIIDAE) AND OF *LAGOSTOMUS MAXIMUS* (DESMAREST, 1817) (RODENTIA: CHINCHILLIDAE) FROM ARGENTINA

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**ABSTRACT:** Of 163 fecal samples collected between March 1997 and February 1999 from the plains vizcacha, *Lagostomus maximus* (Rodentia: Chinchillidae), 19 (12%) were found to be positive for coccidia. All species are from the genus *Eimeria* and 2 are described here as new. The third species is consistent with the description of *Eimeria chinchillae* De Vos and Van der Westhuizen, 1968. Sporulated oocysts of *Eimeria lagostomi* n. sp. are ellipsoidal to subspheroideal, 35.7 × 30.9 (26–36 × 30–41), with a length/width (L/W) ratio of 1.2 (1.0–1.3), without a micropyle (M) or polar granule (PG), but with an oocyst residuum (OR) comprised of a round, compact mass of many small granules. The sporocysts are lemon-shaped, 14.2 × 10.2 (9–11 × 11–16), with an L/W ratio of 1.4 (1.2–1.7) and have a Stieda body (SB) and sporocyst residuum (SR). *Eimeria vizcacha* n. sp. has sporulated oocysts that are subspheroideal, 26.4 × 23.4 (21–27 × 23–31), with an L/W ratio of 1.1 (1.1–1.2), lack an M and OR, but have 1–2 PGs. Sporocysts are elongate-ellipsoidal, 14.3–9.0 (8–10 × 13–15), with an L/W ratio of 1.6 (1.4–1.8), lack an SB, but have 2 SR; the first a small mass of granules lying between the sporozoites in the middle or at 1 end, and the second also of many small granules, always at the opposite end. Sporulated oocysts of the *E. chinchillae*-like organism are ellipsoidal to subspheroideal, 20.7 × 17.5 (15–22 × 17–24) with an L/W ratio of 1.2 (1.0–1.3), lack an M and OR, but have 0–3 PGs. Sporocysts are ellipsoidal, 10.7–6.9 (6–8 × 8–13) with an L/W ratio of 1.55 (1.3–1.8) and have an SB and SR.

Over 450 species of coccidia (Duszynski and Upton, 2001) have been described from rodents to date, but none has been described from the plains vizcacha *Lagostomus maximus* (Rodentia: Chinchillidae). A relative of the vizcacha, the chinchilla (*Chinchilla laniger*) is known to have only 1 species of *Eimeria* (*Eimeria chinchillae*). Nine species of parasites comprised of 5 endoparasitic worms and 4 ectoparasites (lice and fleas) have been associated with *L. maximus*, but no coccidia have been described (Jackson et al., 1996). Thus, as part of a study conducted in Argentina on the plains vizcacha, we collected fecal samples to determine the prevalence of coccidia infections and to complete as much as possible of the biology of these animals in relation to their parasites, ecology, and behavior. We found the rodents to be infected with 3 species of *Eimeria* (APICOMPLEXA: EIMERIIDAE), an *E. chinchillae*-like form and 2 that we describe here as new.

**MATERIALS AND METHODS**

From March 1997 through February 1999, 163 vizcachas from Argentina were caught at night in Tomahawk live traps and held in heavy mesh bags until morning, when they were weighed, measured, and tagged before being released. Approximately 0.5–1 g of feces was collected from the bag containing each host animal and placed in separate vials with 2% (w/v) aqueous potassium dichromate (K₂Cr₂O₇) solution, mixed thoroughly, and stored at ambient temperature for 2–3 mo until they could be shipped back to the United States. The samples were processed and stored at 4°C as detailed by Duszynski and Wilber (1997) until initial screening for coccidia could be done in Florida. No measurements were taken at this time. Positive samples were then sent to the University of New Mexico where oocysts were measured and photographed within 15 days of arrival. All measurements are given in micrometers (μm) with size ranges in parentheses following the means.

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**RESULTS**

Of 19 positive samples, 16 were infected with the first new species, 1 with the second new species only, 1 with both new species, 1 with *E. chinchillae*-like oocysts only, and none with all 3.

**DESCRIPTION**

*Eimeria lagostomi* n. sp.
(Figs. 1, 2, 7)

**Description of oocyst:** Oocyst: ellipsoidal to subspheroideal; number of walls: 2; wall thickness: 1.5; wall characteristics: outer layer rough, yellowish-brown, ~1, inner smooth, colorless; L × W: 35.7 × 30.9 (26–36 × 30–41); L/W ratio: 1.2 (1.0–1.3); M: absent; OR: present; OR characteristics: round, consisting of many compact small granules, ~5.4–9; PG: absent. Distinctive features of oocyst: large size and distinct large OR.

**Description of sporocyst and sporozoites:** Sporocyst: lemon-shaped; L × W: 14.2 × 10.2 (9–11 × 11–16); L/W ratio: 1.4 (1.2–1.7); SB: present, bluntly pointed; SSB: present as a broad extension of the inner membrane of sporocyst; PSB: absent; SR: present; SR characteristics: a few medium-sized granules lying horizontally along middle of sporocyst; SP: fairly indistinguishable, but globular RB appear at each end of sporocyst. Distinctive features of sporocyst: none.

**Taxonomic summary**

*Type host:* *Lagostomus maximus* (Desmarest, 1817), plains vizcacha. Other hosts: None reported to date.

*Type locality:* Argentina, La Pampa Province, Los Valles Ranch, 39°11′0.00″S, 63°42′31.9″W, South America.
Figures 1–6. Nomarski interference contrast photomicrographs of sporulated oocysts. Scale bar = 10 μm. 1, 2. Eimeria lagostomi n. sp. Note the different morphological shapes. 3, 4. Eimeria vizaeha n. sp. Note the 2 SR. 5, 6. E. chinchillae-like oocysts. No photomicrographs were included in the original paper.
by being larger, 35.7 × 30.9 versus 17.5 × 15.5, by having a rough outer wall, and by having an SSB that _E. chincilliae_ lacks.

**Eimeria vizcacha n. sp.** *(Figs. 3, 4, 8)*

*Description of oocyst:* Oocyst: subspheroidal; number of walls: 2; wall thickness: 0.8; wall characteristics: outer layer mostly smooth, but may appear slightly rough in some oocysts, yellowish-brown, ~0.4, inner smooth, colorless; L × W: 26.4 × 23.4 (21–27 × 23–31); L/W ratio: 1.1 (1.1–1.2); M: absent; OR: absent; PG: present; number of PGs: 1–2. Distinctive features of oocyst: none.

*Description of sporocyst and sporozoites:* Sporocyst: elongate-ellipsoidal; L × W: 14.3–9.0 (8–10 × 13–15); L/W ratio: 1.6 (1.4–1.8); SB: absent; PSB: absent; SR: present; SR characteristics: consists of two bodies of many small granules, the larger body lying either between the SP or at one end of sporocyst and the smaller one always lying at the opposite end, giving the appearance of a SSB; SP: lie side by side with a large RB at posterior end and smaller one at anterior end. Distinctive features of sporocyst: two SR.

**Taxonomic summary**

_Type host:_ *Lagostomus maximus* (Desmarest, 1817), plains vizcacha.

*Other hosts:* None reported to date.

*Type locality:* Argentina, La Pampa Province, Los Valles Ranch, 39°11’0.00’S, 63°42’31.9”W, South America.

*Geographic distribution:* Argentina, La Pampa Province, South America.

*Prevalence:* 2 of 163 (1%).

*Sporulation:* Probably exogenous (see above).

*Prepatent and patent periods:* Unknown.

*Site of infection:* Unknown. Oocysts recovered from feces.

*Material deposited:* Photosynthetic of sporulated oocysts deposited in the USNPC, Beltsville, Maryland, USNPC no. 90198.

**Remarks**

Sporulated oocysts of _E. vizcacha_ differ in size from those of _E. chincilliae_ De Vos and Van der Westhuizen, 1968 by being larger, 26.4 × 23.4 versus 17.5 × 15.5, and by having 2 SR that _E. chincilliae_ lacks; they differ from those of _E. lagostomi_ by being smaller, 26.4 × 23.4 versus 35.7 × 30.9, by lacking an OR, and by having 2 SR.

**Eimeria cf. chincilliae** De Vos and Van der Westhuizen, 1968 *(Figs. 5, 6)*

*Description of oocyst:* Oocyst: ellipsoidal to subspheroidal; number of walls: 2; wall thickness: 1.5; wall characteristics: outer layer smooth, colorless, ~1–2, inner smooth, colorless; L × W: 20.7 × 17.5 (15–22 × 17–24); L/W ratio: 1.2 (1.0–1.3); M: absent; OR: absent; PG: present; number of PGs: 0–3. Distinctive features of oocyst: number of PGs and lack of OR.

*Description of sporocyst and sporozoites:* Sporocyst: ellipsoidal; L × W: 10.7 × 6.9 (6–8 × 6–13); L/W ratio: 1.55 (1.3–1.8); SB: present, button-like; SSB: absent; PSB: absent; SR: present; SR characteristics: a granular mass lying on 1 side in the middle of the sporocyst nestled between the SP; SP: slightly bent sausage-shaped, lying opposite each other with a globular RB at each end. Distinctive features of sporocyst: none.

**Taxonomic summary**

_Type host:_ Chinchilla laniger (Molina, 1782), chinchilla.

*Other hosts:* *Lagostomus maximus* (Desmarest, 1817).

*Type locality:* Pretoria District, South Africa, chinchilla farm.

*Geographic distribution:* Pretoria District, South Africa; Argentina, South America.

*Prevalence:* One of 163 (1%).

*Sporulation:* Probably exogenous.

*Prepatent and patent periods:* Unknown.

*Site of infection:* Unknown. Oocysts recovered from feces.

*Material deposited:* Photosynthetic of sporulated oocysts deposited in the USNPC, Beltsville, Maryland, USNPC no. 90199.
Remarks

The only difference between the sporulated oocysts described by De Vos and Van der Westhuizen (1968) and those we found is the number of walls and the occasional presence of 0–3 PGs in our samples. De Vos and Van der Westhuizen (1968) state that oocysts of E. chinchillae have a single-layered wall, while those we saw had 2 walls; they also did not see a PG, while we saw 0–3 PGs in our samples. This discrepancy seems minor considering that all other features of these oocysts are highly consistent with those of E. chinchillae; these differences may be due to the microscope lenses used as well as objectivity/interpretation by different authors. It should also be noted that E. chinchillae was described from chinchillas in S. Africa, which is not their natural habitat, but these animals were imported on chinchilla farms. Although the initial description came from oocysts infecting chinchillas, C. laniger and L. maximus are from the same family (Chinchillidae). Upton et al. (1992) and Hnida and Duszynski (1999) showed from molecular and cross-transmission studies that, although oocysts may appear very similar and come from sympatric hosts, they are not always the same species. In addition, their data indicated that coccidia can cross the genus boundary but most likely do not cross family boundaries. For these reasons, we are reluctant to definitively call this species E. chinchillae; rather, we elect to place it into the E. chinchillae-like category until further molecular data can be collected and cross-transmission studies done.

DISCUSSION

Until now, no coccidia have been reported from the plains vizcacha (Chinchillidae: L. maximus). In the family, only 1 species of coccidia (E. chinchillae) has been found in chinchillas that were imported from South America and raised on chinchilla farms in South Africa. Of 13 genera of rodents from this region of Argentina that are sympatric with L. maximus, only 3 that have been studied for coccidia (Akodon, Phyllostis, and Dolichotis) were found to harbor coccidia infections. None of the coccidia that infect these sympatric genera sufficiently resemble E. lagostomii, E. vizcacha, or E. chinchillae, and because coccidia likely do not often cross family boundaries (Upton et al., 1992; Hnida and Duszynski, 1999), we do not consider them as possible coccidia infecting the plains vizcacha.

Plains vizcachas inhabit lowland areas of southern South America, including Argentina, Bolivia, Chile, and Paraguay, that comprise semiarid and subtropical humid grasslands, dry thorn scrub, and desert scrub (Wilson and Reeder, 1993; Jackson et al., 1996). They are colonial, living in communal burrow systems called vizcacheras. Vizcachas may inhabit these burrows for decades, but in special cases such as when their population levels decline, females and juveniles will leave their vizcachera for the next closest extant vizcachera. In addition, there is a large turnover in the male population each year, with resident males being replaced by immigrant vizcachas (Branch, 1993).

The coccidia are obligate, intracellular parasites that are considered to be highly host specific. Once excreted by an infected animal, the oocysts are quite resistant to many abiotic factors, but ultraviolet radiation and a severe lack of moisture for long periods are detrimental. Because the plains vizcachas inhabit burrow systems, it is likely these factors have little bearing on oocyst survival; in fact, the burrow system makes an ideal habitat for oocyst survival until they are ingested by another suitable host. Additionally, the diet of the plains vizcacha consists primarily of plant material such as grasses and leaves, occasionally seeds and seed pods, as well as bark from shrubs (Branch et al., 1994). They also are coprophagous, which may account somewhat for the persistence of coccidia in the population. Therefore, one would expect that because conditions for oocyst survival are optimal and, along with communal living and coprophagous habits, prevalences of coccidian parasites would be quite high in the plains vizcacha. For example, moles and rabbits that have similar habitats and behaviors, i.e., burrowing and coprophagy, respectively, are known to have prevalence rates of coccidia as high as 80–100% (Duszynski and Upton, 2000). It is surprising, then, that prevalences for vizcachas are so low (12%). Thus, additional sampling is necessary to determine if these rates are truly indicative of coccidia infections in the plains vizcacha.

This study is one of a continuing effort to stress the importance of collaborative efforts between the different biological disciplines, e.g., mammalogists and parasitologists. Because coccidia have direct life cycles, exhibit host specificity and are easily collected in the field via noninvasive methods, studies of host–parasite relationships are ideal ways to use host and parasite data as a means of understanding host–parasite coevolution, host ecology, habitat use, and host behavior.

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LITERATURE CITED


