



## *Eimeria atheridis* n. sp. (Apicomplexa: Eimeriidae), a new coccidium from the western bush viper *Atheris chlorechis* (Pel, 1851) from tropical Africa

David Modrý<sup>1,2,\*</sup>, Petr Nečas<sup>3</sup>, Tomáš Mazuch<sup>1</sup> & Martin Kamler<sup>1</sup>

<sup>1</sup>Department of Parasitology, University of Veterinary and Pharmaceutical Sciences, Palackého 1–3, 612 42 Brno, Czech Republic

<sup>2</sup>Institute of Parasitology, Academy of Sciences of the Czech Republic, České Budějovice, Czech Republic

<sup>3</sup>Sportovní 11, Brno, Czech Republic

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### Abstract

Coprological examination of nine bush vipers *Atheris chlorechis* imported from Ghana revealed the presence of a new coccidian species belonging to *Eimeria* Schneider, 1875. Thin walled oöcysts of *Eimeria atheridis* n. sp. are spherical to slightly subspherical, 22.8 (19–26) × 22.5 (19–25) µm, without micropyle, polar granule and oöcyst residuum. Sporocysts are elongately ellipsoidal, 17.1 (15–19) × 7.5 (6–8) µm, with a dome like, relatively flat Stieda body. Sporozoites possess two refractile bodies and distinct transversal striation. Based on the presence of a Stieda body the species described herein clearly belongs to the *Eimeria* (*sensu stricto*).

### Introduction

Eimerian coccidia of snakes represent a multifarious assemblage of species. So far, about 82 species of *Eimeria* Schneider, 1875 are reported (and named) from ophidian hosts and this genus is thus the most numerous group of snake coccidia (for a complete list see <http://biology.unm.edu/biology/coccidia/home.html>). In the present paper, we report on a new species of *Eimeria* parasitising arboreal bush vipers *Atheris chlorechis* (Pel) imported from West Africa.

### Materials and methods

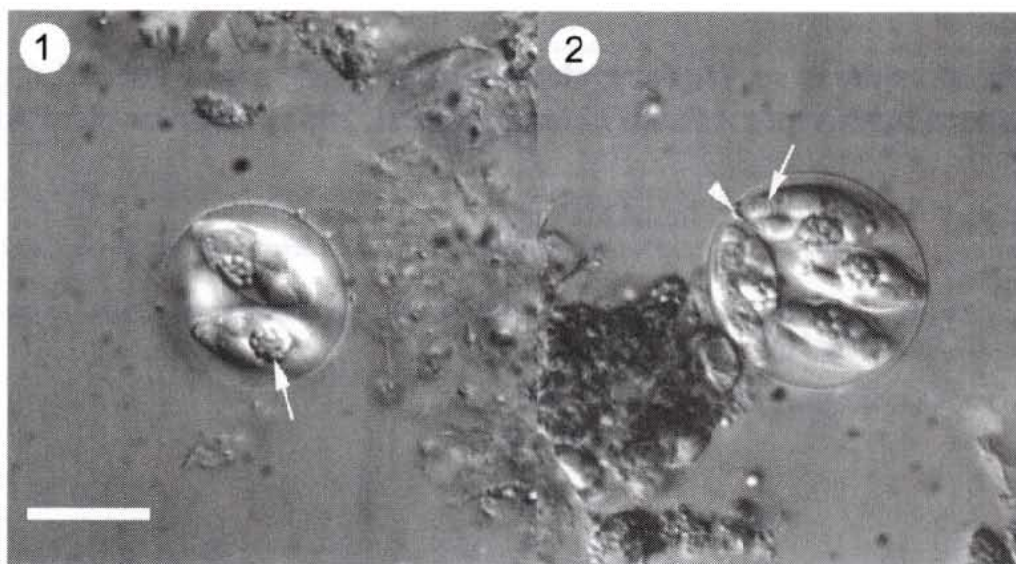
Faecal samples from nine newly imported adult and subadult specimens of western bush viper *Atheris chlorechis* were collected. Vipers imported by a pet trader from Ghana were kept individually in glass terraria in quarantine facilities and fed laboratory mice; animals refusing to eat were force-fed with suckling mice. Faecal samples were collected daily from cages, then placed into the plastic vials with 2.5%

(w/v) potassium dichromate (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>), mixed thoroughly, and examined within 24 h. Samples containing unsporulated coccidian oöcysts were allowed to sporulate in Petri dishes at room temperature (20–23 °C) and examined twice a day to determine the stage of sporulation. All faecal samples were examined microscopically after concentration by flotation with a modified Sheather's sugar solution (s.g. 1.30). As the sporulated oöcyst were collapsed after the flotation, all morphological data were obtained from native preparations. Oöcysts were measured and photographed using differential interference contrast optics (DIC). Measurements were made using a calibrated ocular micrometer and are reported in micrometres, as means, followed by the ranges in parentheses.

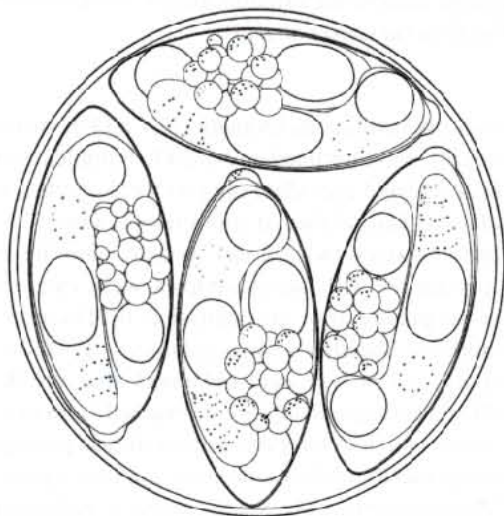
### Results

Coprological examination revealed the presence of oöcysts of an undescribed species of *Eimeria* (*sensu stricto*) (Apicomplexa: Eimeriidae) in 3 of 9 (33%) vipers examined. Infected snakes showed no signs of alteration of their health status and expelled oöcysts in their faeces during the entire two-month period when examined.

\* Author for correspondence



Figures 1–2. Differential interference contrast (DIC) photographs of the oocysts of *Eimeria atheridis* n. sp. 1. Note the globular sporocyst residuum (arrow). 2. Note the dome-like Stieda body (arrowhead) and distinct transverse striation of the sporozoite surface (arrow). Scale-bars: 10  $\mu$ m.



Figures 3. *Eimeria atheridis* n. sp. Composite line drawings of a sporulated oocyst. Scale-bar: 10  $\mu$ m.

### *Eimeria atheridis* n. sp.

#### Description (Figures 1–3)

Oocysts spherical, exceptionally slightly subspherical, 22.8 (19–26)  $\times$  22.5 (19–25); shape index (length: width ratio, SI) 1.0–1.1. Micropyle, polar granule and oocyst residuum absent. Oocyst wall appears as

single-layered, smooth, colourless and <0.5 thick. Sporocysts elongate-ellipsoidal, with slightly pointed end, 17.1 (15–19)  $\times$  7.5 (6–8), with smooth, colourless, unilayered sporocyst wall; sporocyst SI 2.3 (2.1–2.6). Stieda body dome-like, relatively flat, 2 wide  $\times$  0.5–0.7 high; substieda body not observed. Sporozoites elongate, arranged head to tail within sporocyst. Posterior end of each sporozoite with spherical refractile body (2–2.5) folded back; anterior refractile body broadly ellipsoidal (c.4  $\times$  2.5); anterior part of sporozoite bears distinct transverse striation. Sporocyst residuum present, formed by cluster of granules, each 0.5–1 in diameter.

*Type-host*: Western bush viper *Atheris chlorechis* (Pel) (Serpentes: Viperidae: Viperinae).

*Type-locality*: Ghana, detailed locality data unknown.

*Type-specimens*: Photosyntypes are deposited in Department of Parasitology, University of Veterinary and Pharmaceutical Sciences, Brno, Czech Republic under the No. R 132/02.

*Site of infection*: Unknown; oocysts recovered from faeces.

*Sporulation*: Apparently exogenous; oocysts became fully sporulated within 24–36 h in 2.5% potassium dichromate at room temperature of c.22  $^{\circ}$ C.

*Prevalence*: 3 of 9 (33%) examined western bush vipers were infected.

**Etymology:** The specific epithet *atheridis* is derived as genitive form of the host generic name *Atheris*.

## Discussion

Eimeriid coccidia of reptiles represent a diverse assemblage of species differing in both the morphology of exogenous stages (oocysts) and in endogenous development. Based on the combination of sporocyst excystation structures and site, and characters of endogenous development, two main lineages probably having different phylogenetic affinities can be defined within the *Eimeria* (*sensu lato*) parasitising reptilian hosts: (i) species possessing Stieda body on the apical part of sporocyst; and (ii) species with the sporocyst wall composed of two plates joined by a meridian suture (Paperna & Landsberg, 1989). As phylogenetic and taxonomic issues are not yet settled, the majority of authors describing eimeriid coccidia of reptiles tentatively placed them into *Eimeria* (e.g. Asmundsson et al., 2001; Daszak & Ball, 1991; Upton et al., 1993, 1994; Telford, 1997; Daszak & Ball, 1998). Nevertheless, the presence of Stieda bodies allows us to classify *Eimeria atheridis* n. sp. in *Eimeria* (*sensu stricto*) within the Eimeriidae (*sensu* Jirku et al., 2002) and this affiliation is reflected in further discussion and differential diagnosis.

The only previous studies concerning coccidia of African bush vipers of the genus *Atheris* Werner are those by Šlapeta et al. (1999) and Koudela et al. (2000) reporting on *Sarcocystis* and *Caryospora* spp. from *Atheris nitschei* Tornier from the Ruwenzori Mts. No other species of *Eimeria* have been described or reported from African viperid snakes and there are only two species of *Eimeria* (*sensu stricto*) parasitising members of the family Viperidae. *E. bothropis* Lainson, 1968, described from South American *Bothrops atrox* (L.), differs in basic morphometrical characters and both oocyst and sporocyst shape (Lainson, 1968). *E. crotalviridis* Duszynski, Altenbach, Marchiondo & Speer, 1977, described from North American rattle snake *Crotalus viridis* (Rafinesque), differs markedly from *E. atheridis* n. sp. in having ellipsoidal oocysts with a rough oocyst wall and a distinct oocyst residuum (Duszynski et al., 1977).

Although there are several species of *Eimeria* (*sensu stricto*) with spherical, thin-walled oocysts parasitising snakes, only two species are similar enough to be compared with *E. atheridis*. *E. leptodeirae* Asmundsson, Upton & Freed, 2001, from

*Leptodeira annulata* (L.) from Ecuador, differs mainly by its subspherical oocysts and presence of a polar granule. *E. serpenticola* Upton & McAllister, 1990 from the North American *Thamnophis proximus* (Say), can be differentiated based on its smaller, mostly subspherical oocysts with a polar granule (Asmundsson et al., 2001; Upton & McAllister, 1990). The above-mentioned differences justify the description of *E. atheridis* as a new species.

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