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Chris T. McAllister
Eastern Oklahoma State College

Donald W. Duszynski
The University of New Mexico

Robert N. Fisher
United States Geological Survey

Christopher C. Austin
Louisiana State University

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A new species of *Eimeria* Schneider, 1875 (Apicomplexa: Eimeriidae) from the Solomon ground skink, *Sphenomorphus solomonis* (Boulenger) (Sauria: Scincidae) from Papua New Guinea

Chris T. McAllister · Donald W. Duszynski ·
Robert N. Fisher · Christopher C. Austin

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Abstract Between September 1990 and November 1991, 19 *Sphenomorphus* spp. skinks, including nine *S. jobiense*, three *S. simus*, and seven Solomon ground skinks, *S. solomonis* (Boulenger), were collected from Madang and Morobe Provinces, Papua New Guinea (PNG), and examined for coccidia. A single *S. solomonis* was found to be infected with a new species of *Eimeria* Schneider, 1875. Oöcysts of *Eimeria perkinsae* n. sp. are ellipsoidal with a smooth, colourless, bi-layered wall, measure $18.6 \times 14.7 \mu\text{m}$, and have a length/width (L/W) ratio of 1.3; both micropyle and oöcyst residuum are absent, but a fragmented polar granule is present. Sporocysts are ovoidal, $8.9 \times 6.4 \mu\text{m}$, L/W 1.4; neither Stieda, sub-Stieda or para-Stieda bodies are present; a sporocyst residuum consisted of a loose cluster of

granules dispersed between sporozoites. Sporozoites are comma-shaped with spheroidal anterior and posterior refractile bodies. This represents the first report of coccidia from this skink genus.

Introduction

Scincidae is the largest family of lizards with approximately 1,500 described species, representing about 25% of all lizard diversity (Uetz, 2013). Skinks can be found on all the warm continents and exhibit the greatest variety of morphological, physiological, behavioural, reproductive, and life history variation seen in any reptile family. Skinks in the subfamily Lygosominae have their centre of species richness in Australasia (Skinner et al., 2011). The lygosomid skink genus *Sphenomorphus* Fitzinger (tribe Sphenomorphini) is a large and highly diverse group of lizards containing about 120 described species (Uetz, 2013) that has had a long and difficult taxonomic history and very little is known about their parasites. Kreis (1940), Bursey et al. (2005) and Goldberg et al. (2009, 2010) provided descriptions of new helminth species from *Sphenomorphus jobiense* Meyer from Papua New Guinea (PNG). In addition, Austin & Perkins (2006) and Perkins & Austin (2009) reported hematozoa from *S. jobiense* from PNG. However, nothing is known about coccidian parasites of any member of the genus. Here, we provide a description of a new species of *Eimeria* Schneider, 1875 from *S. solomonis* (Boulenger) from PNG.

C. T. McAllister (✉)
Division of Science and Mathematics, Eastern Oklahoma
State College, Idabel, OK 74745, USA
e-mail: cmcallister@se.edu

D. W. Duszynski
Department of Biology, University of New Mexico,
Albuquerque, NM 87131, USA

R. N. Fisher
U.S. Geological Survey, Western Ecological Research
Center, San Diego Field Station, 4165 Spruance Road,
Suite 200, San Diego, CA 92101-0812, USA

C. C. Austin
Department of Biological Sciences, Museum of Natural
Sciences, Louisiana State University, Baton Rouge,
LA 70803, USA

Materials and methods

Between September 1990 and November 1991, 19 *Sphenomorphus* spp. skinks were collected by hand or shot with a dart from a blowpipe from Madang (n = 6) and Morobe (n = 13) provinces, PNG as follows: nine *S. jobiense*, three *S. simus*, and seven *S. solomonis*. Fresh faeces were collected and placed in individual vials containing 2.5% (w/v) aqueous potassium dichromate ($K_2Cr_2O_7$) and examined for coccidia by light microscopy after flotation in Sheather's sugar solution (specific gravity = 1.30). Measurements were taken on 20 sporulated oöcysts using a calibrated ocular micrometer and reported in micrometres with means followed by the ranges in parentheses; photomicrographs were taken using Nomarski interference-contrast optics. Oöcysts were c.300 days old when measured and photographed. Descriptions of oöcysts and sporocysts follow guidelines of Wilber et al. (1998) as follows: oöcyst length (L) and width (W), their ranges and ratios (L/W), micropyle (M), oöcyst residuum (OR), polar granules (PG), sporocyst (SP) length (L) and width (W), their ranges and ratio (L/W), sporocysts (SP), Stieda body (SB), sub-Stieda body (SSB), para-Stieda body (PSB), sporocyst residuum (SR), sporozoites (SZ) anterior (ARB) and posterior (PRB) refractile bodies, and nucleus (N). Skink voucher specimens were accessioned into the California Academy of Sciences (CAS), San Francisco, California, USA as 192848–51, 192881, 243309, and the Texas Natural History Collection (TNHC), Austin, Texas, USA as TNHC 51251, 51259, 51262–66, 51273–75, 51349, 52113–14. Photosyntypes of sporulated oöcysts were accessioned into the United States National Parasite Collection (USNPC), Beltsville, Maryland, USA. Lizard taxonomy follows the reptile database (Uetz, 2013) and Zug (2013).

Results

One of 19 (5%) *Sphenomorphus* spp. skinks was found to be passing an undescribed species of *Eimeria*, which is described below.

Eimeria perkinsae n. sp.

Type-host: Solomon ground skink, *Sphenomorphus solomonis* (Boulenger), symbiotype TNHC 51265 (field no. CCA 0463) collected 26 September 1991.

Type-locality: Papua New Guinea, Morobe Province, Bakia Village No. 1 (7°57'50"S, 147°11'16"E), elevation 900 m.

Type-material: Photosyntype deposited as USNPC 106980.

Prevalence: 1 of 7 (14%).

Sporulation time: Unknown. Specimens were collected in the field, stored in $K_2Cr_2O_7$ solution, and not examined until 300 days later.

Site of infection: Unknown. Oöcysts were passed in faeces and host tissues were not collected or preserved for histological sectioning.

Etymology: The specific epithet is a matronym in honour of Dr. Susan L. Perkins, American Museum of Natural History, New York, New York, USA, in recognition of her contributions to lizard hemoparasite biology, particularly on *Sphenomorphus* spp. skinks from PNG.

Description (Figs. 1–3)

Sporulated oöcyst

Oöcyst (n = 20) colourless, smooth, ellipsoidal; 18.7×14.7 (16–20 \times 13–16); length/width (L/W) ratio 1.3 (1.2–1.5). Wall bi-layered, with equal thickness c.0.5 (0.4–0.6). Micropyle absent, oöcyst residuum absent; fragmented polar granule present.

Sporocyst

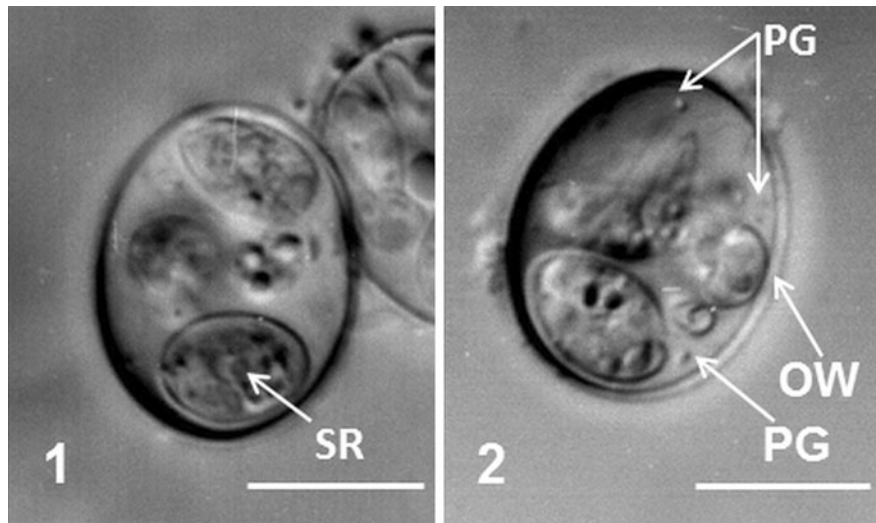
Sporocysts (n = 20) four, colourless, smooth, ovoidal, 8.9×6.4 (7–10 \times 6–7); L/W ratio 1.4 (1.1–1.7); wall single-layered c.0.5. Stieda body, sub-Stieda body, and para-Stieda body absent; sporocyst residuum consists of loose cluster of granules dispersed between sporozoites.

Sporozoite

Sporozoites (not measured) two, comma-shaped; with single spheroidal anterior refractile body, 1.3 (1.0–1.6) (n = 5), and spheroidal posterior refractile body, 2.4 (2.3–2.4) (n = 5), with nucleus between them.

Remarks

There are two similar eimerians reported previously from lizards of the family Scincidae that possess ovoidal oöcysts with mean lengths <20 μ m and with L/W ratios of c.1.3 as follows: *Eimeria lampropholidis* Cannon, 1967 from pale-flecked garden sunskink,



Figs. 1–2 Oöcysts of *Eimeria perkinsae* n. sp. 1, Oöcyst showing sporocyst residuum (SR); 2, Oöcyst showing oöcyst wall (OW) and fragmented polar granule (PG). Scale-bars: 10 μ m

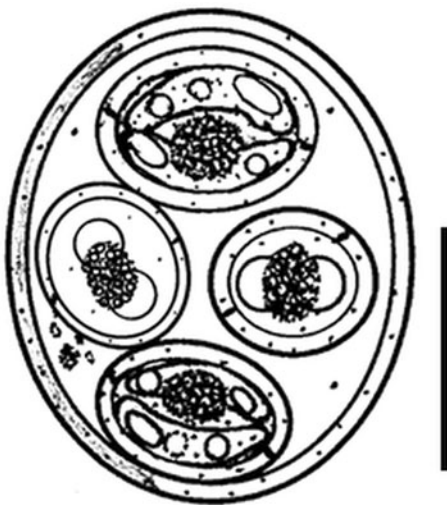


Fig. 3 Composite line drawing of oöcyst of *Eimeria perkinsae* n. sp. Scale-bar: 10 μ m

Lampropholis guichenoti (Duméril & Bibron) from Australia (Cannon, 1967) and *Eimeria leiolopismatis* Cannon, 1967 from orange-tailed shadeskink, *Saprosincus challengerii* (Boulenger) from Australia (Cannon, 1967). However, sporocysts of *E. lampropholidis* are smaller than *E. perkinsae* (7.7×6.5 vs 8.9×6.4) and do not possess a polar granule; sporocysts of *E. leiolopismatis* are described as being ellipsoidal whereas those of *E. perkinsae* are ovoidal. In addition, the host of *E. perkinsae* n. sp., *S. solomonis*, belongs to

the “*Sphenomorphus* group” and *Saprosincus* is in the “*Eugongylus* group”, which means they are phylogenetically distant and, therefore, would not be expected to share coccidia (see figure 1 of Skinner et al., 2011).

Discussion

The genus *Sphenomorphus* is a large complex group of skinks that is poorly known systematically, especially due to their conservative morphology (Linkem et al., 2011). Recent molecular systematic work has shown that the true species diversity in this genus is probably best represented by breaking the group into multiple monophyletic genera (Linkem et al., 2011).

The natural history of *Sphenomorphus* species is quite varied, with species living on the ground, in trees, and fossorially. Of the species studied here, only *S. solomonis* is fossorial, typically collected under surface material such as logs and rocks in primary and secondary rain forest. The new species represents the first coccidian from a fossorial Pacific skink, and continues the trend of generic specificity in coccidians in skinks of the Pacific (Modrý & Jirků, 2006; McAllister et al., 2013a, b, c, d). A broader sampling of sites and species within the current genus *Sphenomorphus* is likely to discover many additional endemic coccidian species.

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