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Caryospora maxima sp. n. (Apicomplexa: Eimeriidae), new coccidium from Forskal's sand snake, *Psammophis schokari* (Serpentes: Colubridae) from lava desert of Jordan

David Modrý[1,2], **Břetislav Koudela**[2], **Ratib M. Al-Oran**[3] and **Zuhair S. Amr**[4]

[1]Department of Parasitology, University of Veterinary and Pharmaceutical Sciences, Palackého 1-3, 612 42 Brno, Czech Republic;

[2] Institute of Parasitology, Academy of Sciences of the Czech Republic, Branišovská 31, 370 05 České Budějovice, Czech Republic;

[3]Department of Biology, Mutah University, Karak, Jordan;

[4]Department of Biological Sciences, Faculty of Sciences, Jordan University of Science and Technology, Irbid, Jordan

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Abstract. A new coccidian parasite of the genus *Caryospora* Léger, 1904 is described from the colubrid snake *Psammophis schokari* (Forskål, 1775). Oocysts of *Caryospora maxima* sp. n. are spherical or subspherical, 43.0 (40.0-46.0) × 42.1 (40.0-44.0) μm, with smooth and bilayered oocyst wall ca. 2.0 μm thick. A micropyle, oocyst residuum and polar granule are absent. Sporocysts are broadly ellipsoidal, 21.3 (21.0-22.0) × 16.3 (16.0-17.0) μm, with smooth, colourless and unilayered sporocyst wall. Stieda and substieda bodies are present. Sporocyst residuum is present as compact mass of granules lying centrally between sporozoites. Sporozoites are elongate, arranged head to tail within sporocyst. *Caryospora maxima* represents the first coccidian species described from *Psammophis schokari.*

Forskal's sand snake, *Psammophis schokari* (Forskål, 1775) is a widely distributed colubrid snake species, occurring in desert and semidesert ecosystems of Sahara and sub-Saharan regions of Africa, in the Near and Middle East, India and republics of the former USSR. No species of coccidium has been described from this species of snake to date. In this paper a species of the genus *Caryospora* is reported for the first time from *Psammophis schokari* and is described as a new species.

MATERIALS AND METHODS

Three adult specimens of *Psammophis schokari* were captured alive during field parasitological and herpetological research in Jordan in April 1996. Collected snakes (one specimen from locality Safawi, 32°12'N; 37°10'E, and two specimens from locality Zoubia 32°25'N; 35°45'E) were placed individually in plastic cages and transported into the Czech Republic. Snakes were housed individually in 15-litre plastic cages in an isolated room at 22-25°C during daytime and 17-20°C during the night. The floor of the cages was covered with paper towels and locally heated by heating pad to 27°C during the day. The snakes were force-fed on juvenile laboratory mice.

Individual faecal samples were repeatedly collected from cages and from grounds of the terraria and were examined microscopically after concentration by flotation with modified Sheather's sugar solution (s.g. 1.30). Oocysts were then measured and photographed using Nomarski interference contrast (NIC) optics. Measurements were made using a calibrated ocular micrometer and are reported in micrometres as means, followed by the ranges in parentheses.

One specimen of *Psammophis schokari* from Safawi was euthanised by overdose of barbiturate (Thiopental®, Spofa, Czech Republic) and necropsied. Tissue samples of stomach, small and large intestine, heart, lung, liver, gall bladder and kidneys were fixed in 10% buffered formalin and processed for light microscopy using standard histological method. Paraffin sections were stained with haematoxylin and eosin (H&E) and Giemsa stains.

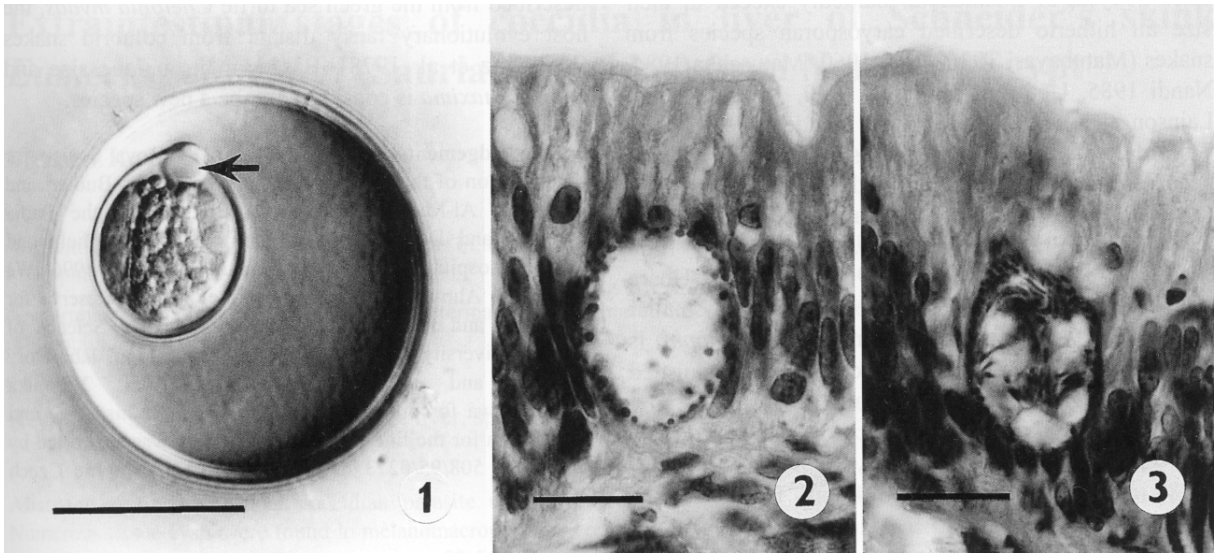
RESULTS

Examination of faecal samples and intestinal content revealed presence of oocysts of previously undescribed coccidian species belonging to the genus *Caryospora* in one of examined snakes.

Caryospora maxima sp. n. Figs. 1-4

Oocysts spherical or subspherical, 43.0 (40.0-46.0) × 42.1 (40.0-44.0); with smooth and bilayered oocyst wall ca. 2.0 thick. Outer layer slightly brownish, 1.5 thick. Shape index (length/width) of sporulated oocysts 1.02. Micropyle, oocyst residuum and polar granule absent. Sporocysts broadly ellipsoidal, 21.3 (21.0-22.0) × 16.3 (16.0-17.0), with smooth, colourless and unilayered

Address for correspondence: D. Modrý, Department of Parasitology, University of Veterinary and Pharmaceutical Sciences, Palackého 1-3, 612 42 Brno, Czech Republic. Phone: ++42 5 4156 2979; Fax: ++42 5 4156 2266; E-mail: modry@dior.ics.muni.cz



Figs. 1-3. *Caryospora maxima* sp. n. **Fig. 1.** Nomarski interference contrast (NIC) photomicrographs of sporulated oocyst. Note substieda body (arrow). **Fig. 2.** Macrogamont. H&E. **Fig. 3.** Microgamont. H&E. Scale bars: Figs. 1-3 = 20 μm.

sporocyst wall ca. 0.5-0.75 thick; shape index 1.3. Stieda body present, knob-like, ca. 1.0 high and 3.0 wide, homogenous globular substieda body present, ca. 4.0 high and 4.5 wide. Sporocyst residuum present as compact mass of granules lying centrally between sporozoites. Sporozoites elongate, arranged head to tail within sporocyst. A single, spherical nucleus was located centrally between refractile bodies.

S p o r u l a t i o n: Apparently exogenous. Fresh oocysts recovered from the intestinal contents were unsporulated. When the intestinal content and faeces were examined later (15 days old) 100% of oocysts were fully sporulated.

S i t e o f i n f e c t i o n : Histological examination revealed endogenous stages developed within cytoplasm of enterocytes in the small intestine, where only stages of gamogony were found (Figs. 2, 3).

T y p e h o s t : Forskal's sand snake *Psammophis schokari* (Forskål, 1775) (Serpentes: Colubridae).

T y p e l o c a l i t y : Safawi, northern Jordan (32°12'N; 37°10'E).

T y p e s p e c i m e n s : Phototypes and histological slides are deposited in the Institute of Parasitology, Academy of Sciences of the Czech Republic, České Budějovice, collection No. R 68/96. Symbiotype is deposited in herpetological collection of Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany (Coll. No. ZFMK63458).

E t y m o l o g y : The specific epithet *maxima* reflects the size of oocysts of the described species, representing the largest member of the genus *Caryospora* in snakes.

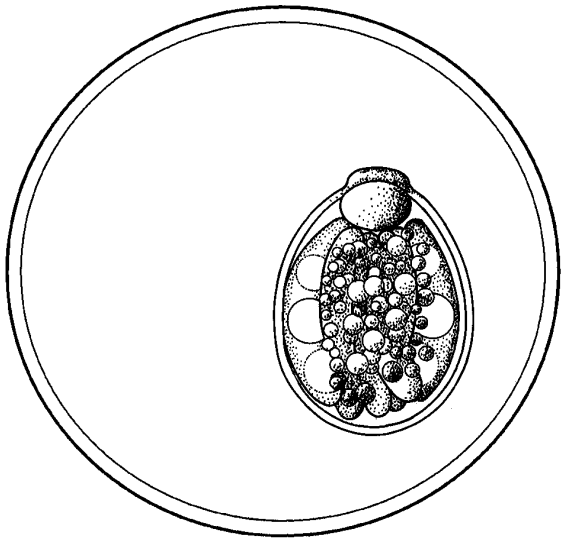


Fig. 4. Composite line drawing of sporulated oocyst of *Caryospora maxima* sp. n. Scale bar = 10 μm.

DISCUSSION

The new species, *Caryospora maxima*, represents the first caryosporan species described from *Psammophis schokari*. It can be easily distinguished from other reptilian members of the genus based on its large oocyst

size. Oocysts of *C. maxima* markedly exceed in their size all hitherto described caryosporan species from snakes (Matubayasi 1936, Bray 1960, Matuschka 1984, Nandi 1985, Upton et al. 1986, 1990, 1992a,b, 1994, Lainson et al. 1991, Modrý and Koudela 1994, 1997, Telford 1997). Four other species of *Caryospora* have been described from members of the genus *Psammophis* to date: *Caryospora hermae* Bray, 1960, *Caryospora legeri* Hoare, 1933, *Caryospora psammophi* Bray, 1960 and *Caryospora weyerae* Bray, 1960 (Bray 1960, Hoare 1933). All of these taxa have significantly smaller oocysts. Even the biggest of them – *C. psammophi*, is markedly smaller (25-37 μm) and could be distinguished also by its slightly pitted oocyst wall.

The largest known *Caryospora* from reptiles is *Caryospora cheloniae* Leibovitz, Rebell et Boucher, 1978, reaching a diameter of 33-40 μm. This species is described from the green sea turtle *Chelonia mydas*, the host evolutionary fairly distant from colubrid snakes (Leibovitz et al. 1978). Based on its unique size and host, *C. maxima* is considered to be a new species.

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