A case of an incidental *Strongyloides stercoralis* infection in the intestine of an Indian monitor lizard (*Varanus bengalensis*)

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Abstract The present study reports a case of an incidental *Strongyloides stercoralis* infection in the intestine of an Indian monitor lizard (*Varanus bengalensis*). Nematode larvae were embedded in the mucosa of the small intestine. The nematodes were small, whitish in colour and measures (2.16 ± 69.85) mm length and (206.75 ± 38.85) μ m width. Histopathologically, the intestine showed tufting of degenerated surface epithelium. There was presence of sections of the nematodes within the mucosa of the intestinal epithelium.

Keywords *Strongyloides stercoralis* · Indian monitor lizard (*Varanus bengalensis*) · Histopathology

Introduction

The Indian monitor lizard (*Varanus bengalensis*) is found widely distributed over the Indian Subcontinent. A broad range of endoparasites viz, nematodes, cestodes and trematodes, have been reported in this reptile (Okulewicz et al. 2015). Of the many nematodes species reported, *Strongyloides stercoralis* is one such nematode which infect this reptile (Greiner and Mader 2006). *S. stercoralis* is a small thread-like, soil dwelling nematode which can infect pet animals (dog and cat) (Thamsborg et al. 2017), reptiles and human. It is prevalent throughout the tropical, subtropical and temperate regions. Reptiles may carry different disease causing agents and can be spread to other animals and even humans (Rataj et al. 2011). The present study report a case of an incidental *S. stercoralis* infection in the intestine of an adult monitor lizard.

Materials and methods

The present study involved an adult monitor lizard which was found dead in the field areas. On post-mortem examination, all the organs were normal except for intestine that showed the presence of parasites within the mucosa and congested lungs. For histopathology, the tissues were collected in 10% neutral buffered formalin and routinely processed. And stained sections were viewed under microscope (Olympus) and photomicrographs were taken at different magnifications. Morphological measurements (length and width) were made on six nematodes with the use of digitally captured images at 20 × magnification and imaging software (ImageJ) and data were expressed as Mean $\pm$ SD.

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Results and discussion

In the present study there was presence of nematodes within the mucosa of the small intestine. All the nematodes observed were females and were very small, whitish in colour and measured (mean $\pm$ SD) $(2160 \pm 69.85) \mu\text{m}$ length and $(206.75 \pm 38.85) \mu\text{m}$ width. The oesophagus measured $(480.93 \pm 21.07) \mu\text{m}$. Further it was rhabditi-form with a short buccal cavity and a posterior bulb in the anterior part (Fig. 1). Thus by observing all these features, the nematodes were identified as *S. stercoralis* (Straka et al. 1996). Histopathologically, the intestine showed tufting of degenerated surface epithelium (Fig. 2) and presence of cross-sections of the nematodes within the mucosa of the intestinal epithelium (Fig. 3). These parasites were surrounded by fibrous connective tissue and mild infiltration of inflammatory cells. The morphology of the parasite

Fig. 1 The rhabditiiform larva: anterior part of the larvae with short buccal cavity and the cylindrical esophagus with a posterior bulb

Fig. 2 Photomicrograph of the intestine showed tufting of degenerated surface epithelium. H&E

Fig. 3 Photomicrograph of the intestine showing the presence of cross-sections of the nematodes within the mucosa of the intestinal epithelium. H&E

showed presence of cuticular layer followed by hypodermis and muscular layer. Within the body cavity, there was presence of pharynx with triradiate (Y-shaped) lumen (Fig. 4) and its walls composed of radial muscles. There was also presence of secondary bacterial infection in the intestine. In the lungs, there were hemorrhages within the alveolar areas. No larvae were found in the lungs.

Strongyloides sp. frequently inhabit the intestinal tract of reptiles (Divers 2016). Reports were available regarding the *S. stercoralis* infestation in reptiles specially snakes but report on monitor lizards was rare. *Strongyloides* sp. eggs were detected in one monitor lizard by Rataj et al. (2011). Morphologically, these nematodes resemble hookworms except for the presence of very unique short buccal cavity. Since *S. stercoralis* is a soil dwelling nematode, it is hypothesized that the monitor lizard might have been

Fig. 4 Photomicrograph of the cross section of larvae showing the presence of pharynx with triradiate (Y-shaped) lumen (arrow) and its walls of radial muscles. H&E

infected by ingestion of the infective larva from the soil. The life cycle of *S. stercoralis* is complex consisting of free-living and parasitic cycles with the potential for autoinfection and multiplication within the host (Iriemenam et al. 2010). Strongyloidiasis is generally benign and asymptomatic infection that can be confirmed by the presence of larvae in stools. In the present study all the nematodes were female. Unlike other soil-transmitted helminths such as hookworm and whipworm whose eggs do not hatch until they are in the environment, the parthenogenetic females (i.e., capable of reproducing without males) of *S. stercoralis*, which is embedded in the intestinal mucosa, deposit the embryonated eggs that hatch in situ thereby releasing the rhabditiform larvae in the intestinal wall (Siddiqui and Berk 2001). Infection by nematodes is usually direct, suggesting that the monitor lizard obtained the nematodes from the faeces of the contaminated animals.

In the present study the intestinal epithelial cells were denuded with inflammatory cells infiltration. *Strongyloides* spp. is known to infect lizard and may cause pathology in the intestinal tract (Devoe 2016). Poor sanitary conditions, high temperatures and high humidity levels contribute to the development of the free-living stage and consequently increase the parasitic load (Greiner and Mader 2006). Herein we report a case of an incidental *S. Stercoralis* infestation in a monitor lizard. This study will provide an additional knowledge on the incidence of the parasites in reptiles.

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Authors' contributions GDL, AQM and NDS collected samples and processed for histopathology. GDL and NDS wrote the manuscript.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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