

## GASTROINTESTINAL PARASITISM AND MITE INFESTATION IN *ECHIS OCELLATUS* SNAKES IN NORTHERN NIGERIA: CASE REPORT

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### ABSTRACT

This is a report of cases of gastrointestinal parasitism in *Echis ocellatus* snakes from Northern Nigeria. Twenty adult snakes were captured and sent from Kaltungo, Gombe State, to the Department of Veterinary Pharmacology and Toxicology, Ahmadu Bello University, Zaria. As part of the routine examination protocol, faecal samples and skin scrapings were obtained and examined microscopically. Of the 20 samples analysed, 14 (70%) revealed no detectable parasitic forms, while 6 (30%) contained various parasites, including *Strongyloides* spp., *Kalicephalus* spp., *Eimeria* spp., and mite eggs. The findings suggest potential health implications for *E. ocellatus* populations and highlight the need for further research to understand the impact of parasitic infections on this species' health, behaviour, and conservation.

**Keywords:** *Echis ocellatus* parasites, *Strongyloides*, *Kalicephalus*, *Eimeria*, Nigeria

### INTRODUCTION

Snakes play a crucial role in ecosystems as both predators and prey, contributing to the regulation of rodent populations and serving as indicators of environmental health (Luiselli *et al.*, 2002). Among venomous snakes in Africa, *Echis ocellatus* (West African carpet viper) is of particular medical importance due to its high incidence of envenomation in humans, leading to significant morbidity and mortality (Warrell, 2010). Found predominantly in savannah regions of West Africa, including Nigeria, this species is responsible for more snakebite deaths than all other African snake species combined (Chippaux, 2011).

While the venomous nature of *E. ocellatus* has been extensively studied, there is a paucity of information regarding its own susceptibility to diseases, including parasitic infections. Parasites can have profound effects on

their hosts, impacting growth, reproduction, and survival (Poulin, 1998). In reptiles, gastrointestinal parasites can cause symptoms ranging from mild discomfort to severe disease and death, potentially affecting population dynamics (Jacobson, 2007).

Understanding the parasitic fauna of *E. ocellatus* is essential for several reasons. First, it provides insight into the health status of wild snake populations, which can inform conservation efforts. Second, knowledge of parasites can contribute to understanding the epidemiology of zoonotic diseases, as some reptile parasites may have implications for human health (Telford, 2018).

Lastly, parasitic infections could influence the behavior and venom production of snakes, indirectly affecting the risk of snakebite incidents (Vergles Rataj *et al.*, 2011).

This study aims to identify gastrointestinal parasites present in *E. ocellatus* from Northern Nigeria by analyzing faecal samples. By documenting the parasitic species associated with this medically significant snake, we hope to contribute to the broader understanding of reptile parasitology in the region and highlight areas for future research.

### CASE REPORT

Twenty (20) adult *Echis ocellatus* faecal samples were presented to the Veterinary Helminthology Laboratory, Department of Veterinary Parasitology and Entomology, Ahmadu Bello University, Zaria for routine examination. The samples were collected (by abdominal milking) promptly after defecation. Samples were placed in labeled and analyzed within 24 hours of collection to preserve parasite viability. The snakes were earlier captured by local snake handlers in Kaltungo Local Government Area in Gombe State, Nigeria. They were captured between June and August 2023, coinciding with the rainy season when snake activity is heightened in the area. The snakes were transported in secure containers to the Department of Veterinary Pharmacology and Toxicology, Ahmadu Bello University, Zaria for teaching and research purposes. Each snake was housed individually in a controlled environment to reduce stress and the enclosures were monitored.

### LABORATORY PROCEDURE

The flotation technique was employed to concentrate and isolate parasitic eggs and oocysts from the faecal samples, following the method described by Zajac & Conboy (2012). Approximately 2 grams of each faecal sample were placed into clean containers, to which 10 milliliters of a flotation solution—saturated sodium chloride solution with a specific gravity of 1.20—was added. The samples were thoroughly mixed to create uniform suspensions, ensuring that the parasitic elements were evenly distributed within the solution.

To remove large debris and obtain a clearer sample for examination, the mixtures were strained through a fine mesh. The strained solutions were then carefully poured into centrifuge tubes, filling them to the brim to create a convex meniscus at the top. This careful filling was crucial to maximize the surface area for parasite recovery. A coverslip was gently placed on top of each tube, taking care to avoid trapping air bubbles between the coverslip and the solution, as bubbles could interfere with parasite adhesion.

The centrifuge tubes were then subjected to centrifugation at 1,500 revolutions per minute for five minutes. This step enhanced the recovery of parasitic eggs and oocysts by forcing them to float to the surface and adhere to the underside of the coverslip due to the high specific gravity of the flotation solution. After centrifugation, the coverslips—now with potential parasitic forms attached—were gently

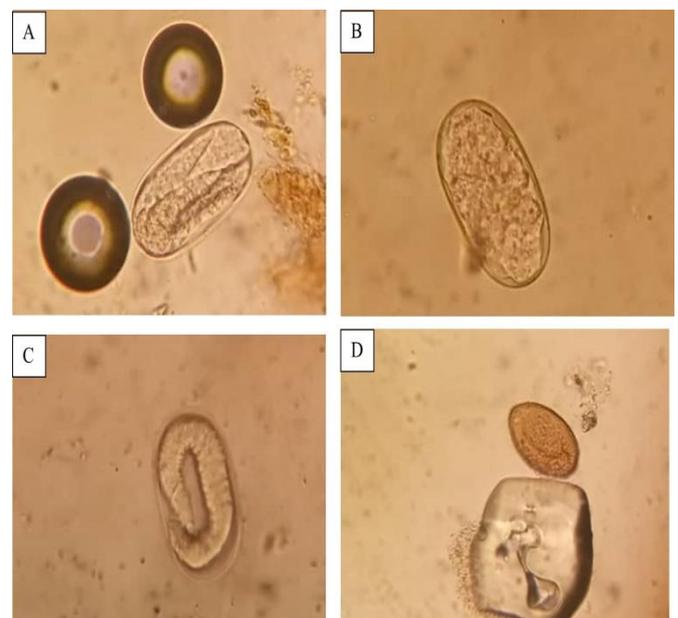
lifted and placed onto clean glass slides for microscopic examination. This method allowed for the effective concentration of parasites, facilitating their identification under the microscope at magnifications of 100x and 400x.

### MICROSCOPIC EXAMINATION

Slides were examined under a light microscope at 100x and 400x magnifications. Parasite identification was based on morphological characteristics described in standard parasitology texts (Foreyt, 2013). Photomicrographs of representative eggs and oocysts were taken using a digital microscope camera. The mites were identified based on the guides provided by Krantz & Walter (2009).

### LABORATORY FINDINGS

Out of the 20 faecal samples analyzed samples 6 (30%) contained various parasitic forms. Fourteen (14) samples (70%) showed no detectable parasitic eggs or oocysts. *Strongyloides* spp. eggs were found in 3 samples (15%). Eggs were oval, thin-shelled, and larvated, measuring approximately 50-60  $\mu\text{m}$  in length (Figure I). *Kalicephalus* spp. eggs were observed in 2 samples (10%). Eggs were thick-shelled with a morulated embryo, measuring approximately 70-80  $\mu\text{m}$  in length. *Eimeria* spp. oocysts were found in 2 samples (10%). Oocysts were oval, with a double-layered wall, measuring approximately 15-25  $\mu\text{m}$  in diameter. Storage mite, a so-called hypopus (intestinal transit) in 1 sample (5%). Eggs were large, smooth-shelled, and oval, measuring approximately 100-150  $\mu\text{m}$  in length (Figure 1D).



**Figure I A and C: *Strongyloides* eggs; B: *Kalicephalus* eggs in *Echis ocellatus* snakes. D: Mite eggs (black arrows)**

**TABLE I: A SUMMARY OF THE PARASITES FOUND IN *ECHIS OCELLATUS* FAECAL SAMPLES**

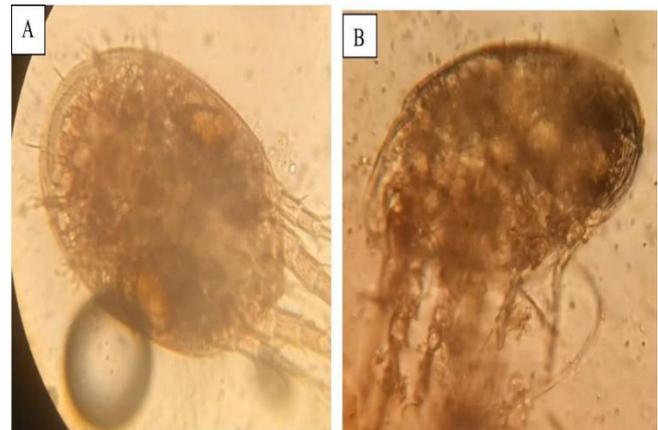
Parasites Identified	Number of <i>Echis ocellatus</i>	Prevalence (%)
<i>Strongyloides</i> spp. eggs	3	15%
<i>Kalicephalus</i> spp. eggs	2	10%
<i>Eimeria</i> spp. oocysts	2	10%
Mites (adult and eggs)	1	5%

**TABLE II: SINGLE AND MIXED INFECTION OF THE PARASITES FOUND IN *ECHIS OCELLATUS* FAECAL SAMPLES**

Parasites Identified	Number of <i>Echis ocellatus</i>	Prevalence (%)
<b>Single infection</b>		
<i>Strongyloides</i> spp. eggs	2	10%
<i>Eimeria</i> spp. oocysts	1	5%
Mites (adult and eggs)	1	5%
<b>Mixed Infection</b>		
<i>S. spp. and K. spp.</i>	1	5%
<i>E. spp. oocysts and K. spp.</i>	1	5%
Not Infected	14	70%
<b>Total</b>	<b>20</b>	<b>100</b>



**Figure II: *Echis ocellatus* snakes**



**Figure III: Storage mite (intestinal transit) in faecal flotation. Pictured is a so-called hypopus**

Some samples exhibited multiple parasitic infections:

- One sample contained both *Strongyloides* spp. and *Kalicephalus* spp. eggs.
- Another sample contained both *Eimeria* spp. oocysts and *Kalicephalus* spp. eggs.

**DISCUSSION**

The detection of gastrointestinal parasites in *Echis ocellatus* from Northern Nigeria provides valuable information on the health status of these snakes in the wild. The presence of parasites in the snakes suggests that a significant portion of the population may harbor parasitic infections, which could have implications for their health and ecological role.

The identification of *Strongyloides* spp. eggs in 15% of samples indicates a notable presence of this nematode in the snake population. *Strongyloides* spp. are known to infect a variety of reptiles, including snakes, and can cause enteritis, anorexia, and weight loss (Telford, 2018). The life cycle involves both free-living and parasitic stages, allowing for environmental persistence and reinfection. The presence of *Strongyloides* spp. may be influenced by environmental factors such as humidity and temperature, which affect the development and survival of larvae. Snakes in captivity or high-density areas may be at increased risk due to contamination of enclosures.

Hookworms of the genus *Kalicephalus* were found in 10% of samples. These parasites attach to the intestinal mucosa, feeding on blood and tissue fluids, potentially causing anaemia and intestinal ulceration (Jacobson, 2007). The co-infection of *Kalicephalus* spp. with *Strongyloides* spp. in one sample raises concerns about additive pathogenic effects. The detection of *Kalicephalus* spp. aligns with reports of hookworm infections in other snake species globally (Goldberg *et al.*, 2013). The ecological implications include potential impacts on snake fitness and survival, particularly in young or immunocompromised individuals.

The identification of *Eimeria* spp. oocysts in 10% of samples suggests exposure to coccidian parasites. *Eimeria* spp. infect

the intestinal epithelial cells, leading to coccidiosis characterized by diarrhoea, dehydration, and malabsorption (Greiner & Mader, 2006). While reptiles are known hosts for various *Eimeria* species, the specific species infecting *E. ocellatus* requires further molecular characterization.

Environmental contamination plays a significant role in the transmission of *Eimeria*, as oocysts are shed in faeces and can persist in the environment. High-density habitats or shared basking sites may facilitate spread among snakes.

Many storage mites are able to introduce an additional developmental stage in unfavourable living conditions, which can be occasionally found in reptile faeces or on rare locations on reptiles. This so-called deutonymph stage (hypopus) appears between protonymph and tritonymph stages and allows survival in adverse living conditions in the habitat (Castro *et al.*, 2019).

The presence of mite eggs in one sample indicates exposure to ectoparasites. Mites can act as vectors for pathogens, cause anaemia through blood feeding, and induce stress in reptiles (Spitzen-van der Sluijs *et al.*, 2011). Infestation may reflect environmental conditions or interactions with other wildlife harboring mites.

Parasitic infections can adversely affect snake health by causing direct pathology, weakening the immune system, and altering behavior (Jacobson, 2007). In the context of *E. ocellatus*, compromised health may reduce hunting efficiency, reproductive success, and resilience to environmental stressors.

Moreover, considering the medical importance of *E. ocellatus*, understanding factors that influence their population dynamics is essential. High parasitic loads could potentially reduce snake populations, which may have ecological consequences and affect the incidence of snakebites in humans.

While this study provides preliminary data, it is limited by the small sample size and the lack of assessment of seasonal variation. Additionally, only faecal samples were analyzed, which may not detect all parasitic infections, such as those present in other organs. Clinical evaluations of the snakes were not conducted, so the health status and clinical impact of the parasites remain unknown. Future research should include larger, longitudinal studies to assess temporal patterns, molecular identification of parasites for precise species determination, clinical assessments to correlate parasitic infections with health parameters, and investigations into environmental factors influencing parasite prevalence.

## CONCLUSION

The cases identified gastrointestinal parasites in *Echis ocellatus* from Northern Nigeria, including *Strongyloides* spp., *Kalicephalus* spp., *Eimeria* spp., and mite eggs. The findings highlight the presence of parasitic infections that

could impact snake health and ecology. Regular monitoring and further research are necessary to understand the full extent of parasitism in snake populations and its implications for conservation and public health.

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## REFERENCES

- Castro, P. D. J., Pietzsch, M. & Pantchev, N. (2019). Ectoparasites in captive reptiles. *The Veterinary Nurse*, 10(1), 33-41.
- Chippaux, J. P. (2011). Snakebite envenomation turns again into a neglected tropical disease! *Journal of Venomous Animals and Toxins Including Tropical Diseases*, 17, 329–333.
- Foreyt, W. J. (2013). *Veterinary Parasitology Reference Manual* (5th ed.). Wiley-Blackwell.
- Goldberg, S. R., Bursey, C. R. & Kraus, F. (2013). Gastrointestinal parasites of 14 species of snakes from Papua New Guinea. *Comparative Parasitology*, 80, 259–266.
- Greiner, E. C. & Mader, D. R. (2006). Parasites of reptiles. In Mader, D. R. (Ed.), *Reptile Medicine and Surgery* Saunders Elsevier, pp. 343–364.
- Jacobson, E. R. (2007). Parasites and parasitic diseases of reptiles. In Jacobson, E. R. (Ed.), *Infectious Diseases and Pathology of Reptiles*, CRC Press, pp. 571–665.
- Krantz, G. W. & Walter, D. E. (Eds.). (2009). *A Manual of Acarology* (3rd ed.). Texas Tech University Press.
- Luiselli, L., Angelici, F. M. & Akani, G. C. (2002). Activity patterns and habitat selection of *Mehelya crossi* (Reptilia, Serpentes) in the rainforests of southern Nigeria: Preliminary data. *Journal of Tropical Ecology*, 18, 375–384.
- Poulin, R. (1998). *Parasites in Ecological Communities: From Interactions to Ecosystems*. Cambridge University Press.
- Spitzen-van der Sluijs, A., Spitzen, J., Houston, D. & Slob, A. (2011). *Ophionyssus natricis* infestation in captive snakes in the Netherlands. *European Journal of Wildlife Research*, 57, 477–481.
- Telford, S. R., Jr. (2018). *Hemoparasites of the Reptilia: Color Atlas and Text*. CRC Press.

- Vergles Rataj, A., Lindtner-Knific, R., Vlahović, K., Mavri, U. & Dovč, A. (2011). Parasites in pet reptiles. *Acta Veterinaria Scandinavica*, 53(33), 1-20.
- Warrell, D. A. (2010). Snake bite. *The Lancet*, 375, 77–88.
- Zajac, A. M. & Conboy, G. A. (2012). *Veterinary Clinical Parasitology* (8th ed.). Wiley-Blackwell.