

OVOSCOPIC DETECTION OF PARASITOLOGICAL FINDINGS IN CAPTIVE SNAKES FROM BULGARIA: A 2025 SURVEY

Seven Mustafa^{1*}, Radoslav Rafailov², Kostadin Kanchev², Evmorfiya Ivanova³,
Polina Petrova³

Faculty of Veterinary Medicine, University of Forestry, Sofia, Bulgaria

¹*Department of Surgery, Radiology, Obstetrics, and Gynecology*

²*Department of Infectious Pathology, Hygiene, Technology and Control of Foods from Animal Origin*

³*Student of Veterinary Medicine*

Corresponding e-mail: s.mustafa@ltu.bg

ORCID: 0000-0002-5895-5796 S.M.; 0009-0003-9001-0121 R.R.; 0000-0001-5430-3734 K.K.

(Submitted: 7 March 2026; Accepted: 5 May 2026; Published: 30 June 2026)

ABSTRACT

The present study summarizes the parasitological findings detected in fecal samples from captive snakes in Bulgaria, based on coproovoscopic examinations conducted in 2025. A total of 197 samples were obtained from snakes kept in private collections, pet shops, and veterinary clinics. A conventional zinc sulfate (ZnSO₄) flotation technique was used for diagnostic evaluation. Parasitological findings were detected in 36% of the samples, with the vast majority of positive samples containing oxyurid eggs most likely originating from feeder rodents. These findings likely represent transient passage of rodent-origin parasitic elements rather than true intestinal infection in snakes. A single sample also contained cestode-type eggs. The results highlight the value of regular parasitological screening in captive reptiles and provide baseline data for reptile health management in Bulgaria.

Key words: captive snakes, intestinal parasites, ovoscopy, pseudoparasitism, oxyurid eggs, cestodes, reptiles.

Introduction

The popularity of exotic pets, including reptiles such as snakes, has increased significantly over the past few decades (Warwick *et al.*, 2018), both globally and in Bulgaria. While captive conditions may limit exposure to certain environmental pathogens, intestinal parasitic infections remain a common and sometimes underestimated concern in these animals (Rataj *et al.*, 2011; Papini *et al.*, 2011). Parasites may cause outcomes ranging from asymptomatic carriage to severe gastrointestinal disease, particularly in cases of poor husbandry or delayed diagnosis.

The reptile population in Bulgaria remains unknown, as does the prevalence of parasitic infections within this population. According to Papini *et al.* (2011), approximately 57% of captive-bred reptiles harbor intestinal parasites. Our earlier research demonstrated that 17% of the analyzed samples harbored parasitological findings, primarily rodent-origin oxyurid eggs (Mustafa *et al.*, 2018). Routine fecal screening represents an important component of preventive veterinary care in reptiles. Among the available diagnostic tools, ovoscopic methods, particularly flotation and sedimentation techniques, are widely used due to their affordability and effectiveness in detecting helminth eggs and protozoan oocysts (Divers and Mader, 2005). Despite their importance, there is a lack of comprehensive parasitological data on captive snakes in Bulgaria, and regional studies remain limited in scope and scale.

Materials and Methods

This study was based on coprological samples collected from 197 captive snakes, representing 33 species and aged between 5 months and 13 years. Samples were submitted from 23 cities across Bulgaria (Fig. 1) and examined at the Scientific and Educational Laboratory of Parasitology of the Faculty of Veterinary Medicine, University of Forestry – Sofia, between January and May 2025.

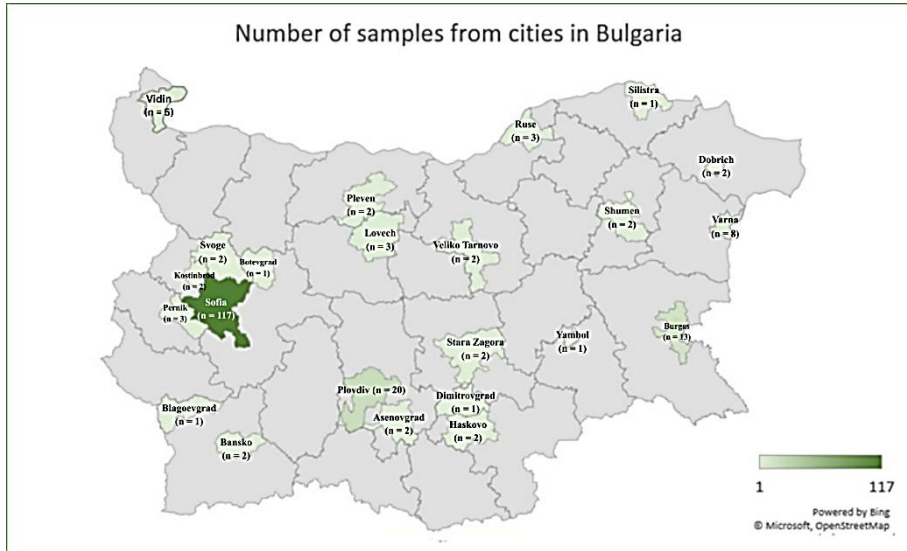


Figure 1: Cities and number of submitted samples.

The examined snakes belonged to three major snake families: Pythonidae ($n = 95$), Boidae ($n = 46$), and Colubridae ($n = 56$). Each snake was represented by a single fecal sample. Samples were collected shortly after defecation by the owners or veterinarians and submitted for parasitological examination. Until analysis, samples were stored under refrigerated conditions ($4-8\text{ }^{\circ}\text{C}$) and were examined within 24 hours of submission. At the time of sample submission, the animals had no reported gastrointestinal clinical signs suggestive of parasitic disease, such as diarrhea, regurgitation, anorexia, weight loss, or the presence of blood in the feces. In addition, the submitted fecal samples were generally well-formed and showed no visible abnormalities. Based on the available history and fecal characteristics, the snakes were considered clinically healthy for the purposes of the present survey.

Samples were examined using the zinc sulfate flotation technique according to the method of Faust *et al.* (1939). Slides were examined using a compound light microscope under $4\times$, $10\times$, and $40\times$ objective lenses. Parasitological findings were recorded and identified at the genus level.

Results

Of the 197 fecal samples analyzed, oxyurid eggs were detected in 71 samples (36%), while one sample (0.5%) additionally contained a cestode-type egg. Detailed species-specific results are presented in Table 1.

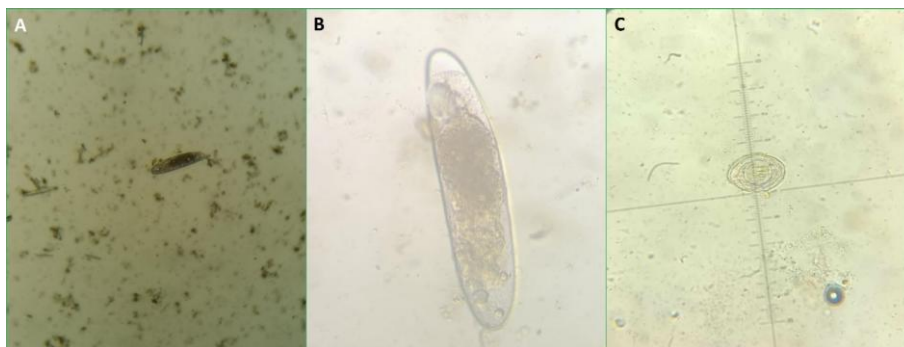


Figure 2: Ovosopic findings: A – rodent-origin oxyurid egg (mag. 4×); B – rodent-origin oxyurid egg (mag. 40×); C – cestode-type egg (mag. 40×).

The detected oxyurid eggs exhibited morphological characteristics consistent with those of rodent oxyurids (Fig. 2A, Fig. 2B). The distribution of oxyurid eggs across the three snake families was as follows:

- Pythonidae: 35 positives out of 95 tested (36%)
- Boidae: 12 positives out of 46 tested (26%)
- Colubridae: 24 positives out of 56 tested (42%)

These proportions are presented for descriptive purposes only, and no statistical comparison among snake families was performed.

Table 1: Species distribution of examined snakes and detected parasitological findings.

<i>F</i>	<i>Species – Latin name (Common name)</i>	<i>n</i>	(+)	<i>Finding</i>
Pythonida (n = 95)	<i>Leiopython albertisii</i> (White-lipped python)	1	-	-
	<i>Liasis fuscus</i> (Australian water python)	1	-	-
	<i>Liasis mackloti savuensis</i> (Savu Island python)	1	-	-
	<i>Malayopython reticulatus</i> (Reticulated python)	7	4	Ro-Ox
	<i>Morelia spilota</i> (Carpet python)	8	4	Ro-Ox
	<i>Morelia viridis</i> (Green tree python)	2	2	Ro-Ox
	<i>Python bivittatus</i> (Burmese python)	5	1	Ro-Ox
	<i>Python breitensteini</i> (Borneo short-tailed python)	2	2	Ro-Ox
	<i>Python brongersmai</i> (Blood python)	2	-	-
	<i>Python molurus</i> (Indian python)	9	3	Ro-Ox
	<i>Python regius</i> (Ball python)	56	19	Ro-Ox
	<i>Simalia nauta</i> (Tanimbar python)	1	-	-
Boidae (n = 46)	<i>Acrantophis dumerili</i> (Dumeril's boa)	6	1	Ro-Ox
	<i>Acrantophis madagascariensis</i> (Madagascar ground boa)	2	2	Ro-Ox
	<i>Boa constrictor</i> (Red-tailed boa)	4	1	Ro-Ox
	<i>Boa imperator</i> (Common northern boa)	23	5	Ro-Ox
	<i>Boa occidentalis</i> (Argentinian boa)	2	-	-
	<i>Candoia paulsoni</i> (Solomon Islands ground boa)	1	-	-
	<i>Corallus caninus</i> (Emerald tree boa)	1	-	-

	<i>Epicrates cenchria</i> (Rainbow boa)	2	1	Ro-Ox	
	<i>Eryx colubrinus</i> (Kenyan sand boa)	2	-	-	
	<i>Eunectes notaeus</i> (Yellow anaconda)	3	2	Ro-Ox	
Colubridae (n = 56)	<i>Boaedon lineatus</i> (Striped house snake)	2	2	Ro-Ox	
	<i>Bothrophthalmus lineatus</i> (Red-black striped snake)	2	-	-	
	<i>Elaphe taeniura</i> (Beauty rat snake)	3	1	Ro-Ox	
	<i>Heterodon nasicus</i> (Western hognose snake)	5	1	Ro-Ox	
	<i>Lampropeltis californiae</i> (California kingsnake)	5	2	Ro-Ox	
	<i>Lampropeltis triangulum campbelli</i> (Campbell's milk snake)	2	-	-	
	<i>Lampropeltis triangulum hondurensis</i> (Honduran milk snake)	2	1	Ro-Ox	
	<i>Lampropeltis triangulum sinaloae</i> (Sinaloan milk snake)	1	-	-	
	<i>Lampropeltis zonata</i> (California mountain kingsnake)	1	-	-	
	<i>Pantherophis guttatus</i> (Corn snake)	32	16	Ro-Ox, Ce	
	<i>Spalerosophis atriceps</i> (Black-headed royal snake)	1	1	Ro-Ox	
	TOTAL		197	71	

F: family; *n*: number of samples examined for each species; (+): number of positive samples; **Ro-Ox**: rodent-origin oxyurid eggs; **Ce**: cestode-type eggs;

Discussion

Most samples originated from Sofia, Plovdiv, and the coastal cities of Burgas and Varna. This likely reflects the higher concentration of exotic pet owners and veterinary services in these regions.

All positive samples contained rodent-origin oxyurid eggs. These results agree with our earlier study (Mustafa *et al.*, 2018), which reported morphologically similar oxyurid eggs, suggesting transient passage of parasitic elements following ingestion of infected prey rather than representing true infection of snakes. Similar findings have been reported in other European studies of captive reptiles. Rataj *et al.* (2011) reported a high prevalence of gastrointestinal parasites in pet reptiles in Slovenia, while Papini *et al.* (2011) documented frequent coprological findings in captive reptiles in Italy. However, direct comparisons between studies should be interpreted cautiously because of differences in animal populations, husbandry conditions, and diagnostic methods. Only one corn snake (*Pantherophis guttatus*) presented concurrent rodent-origin oxyurid eggs and cestode-type eggs. The cestode *Ophiotaenia europaea* has previously been reported in a colubrid snake in Bulgaria (Biserkov and Genov, 1988). However, species-level identification cannot be made based on egg morphology alone, as these structures are often very similar between taxa. Cestode presence is generally infrequent, with aquatic snakes showing a higher tendency toward cestode infestation compared to rodent-fed snakes (Rajesh *et al.*, 2015; Akhila *et al.*, 2018).

It is important to note that the presence of rodent-origin oxyurid eggs in snake feces is not always indicative of an active infection, as these nematodes are highly host-specific to rodents and do not complete their life cycle in snakes (Okulewicz *et al.*, 2014). The eggs most likely originate from ingestion of infected feeder rodents and pass through the gastrointestinal tract without further development. This phenomenon has been well-documented in previous references (Wright, 2009). In our samples, most detected oxyurid eggs measured 175-200 x 45-70 μm , which is larger than the typical size of oxyurid species infecting reptiles, further supporting this interpretation.

Such findings may be misinterpreted and lead to unnecessary antiparasitic treatment if not carefully evaluated. This can affect the well-being of the snakes and create confusion for their caretakers or veterinarians. Proper parasite identification, combined with an understanding of host-specificity, helps reduce diagnostic errors and avoid unnecessary treatment. These findings also highlight another important issue – the hygiene and health status of feeder rodents. The fact that most of the parasites we detected were likely introduced through feeder prey underscores the importance of maintaining parasite-free rodent colonies. Breeders should regularly monitor rodent colonies for parasitic infections and maintain strict hygiene practices to minimize the risk of parasite transmission (Ballard & Cheek, 2003).

Routine oviscopic examination using flotation methods remains a valuable, non-invasive diagnostic tool (Takano *et al.*, 2024) for monitoring the gastrointestinal health of captive snakes. Regular screening during quarantine and periodic monitoring are recommended, particularly in large collections or breeding facilities (Raś-Noryńska & Sokół, 2015).

The present study has several limitations. We acknowledge that using only a single flotation method may not detect heavier parasitic eggs. Additionally, the limited number of samples available from less commonly kept species reduces the ability to generalize prevalence trends across all exotic snake taxa in Bulgaria. Cestode-type eggs detected in one corn snake were not observed during subsequent examinations, possibly due to intermittent shedding. This highlights the need for repeated testing and the use of complementary diagnostic techniques, such as sedimentation methods or molecular assays, to improve detection accuracy in future studies (Wolf *et al.*, 2014).

Regional comparisons with studies from other European countries would be valuable to determine whether the observed prevalence patterns reflect broader epidemiological trends or are influenced by local feeding and husbandry practices. While zoonotic potential from these parasites is considered negligible, accurate diagnosis remains crucial to uphold snake welfare, prevent over-treatment, and support public confidence in exotic pet care.

Conclusion

Consistent with our previous findings, the most frequently observed parasitological findings were rodent-origin oxyurid eggs, most likely introduced through feeder prey. These eggs were not associated with clinical symptoms, confirming their transient, non-infective nature in snakes. Most positive samples originated from ball pythons (*Python regius*), corn snakes (*Pantherophis guttatus*), and common northern boas (*Boa imperator*), which are among the most commonly kept species in private collections. No clear pattern of prevalence was observed with respect to the age or species of the snakes.

The findings underscore the value of regular fecal examinations, both for health surveillance and to prevent the misinterpretation of contaminant eggs as true parasitic infections. Special attention should be paid to the parasitological status of feeder rodents, as maintaining parasite-free feeder colonies may contribute substantially to improving reptile welfare.

Declaration of conflicting interests

The authors declare that there are no conflicts of interest related to the conduct, authorship, or publication of this study.

Ethical requirements statement

The authors affirm that all procedures related to the parasitological examination of the captive snakes complied with relevant animal welfare regulations and ethical guidelines. Informed consent was obtained from the owners for the collection and analysis of samples and the use of associated data in this survey.

References

1. Akhila, S., V. Sukanya, A. Anto, S. Karunakaran. (2018). *Prevalence of endoparasites in captive snakes of Kerala, India*. *Annals of Parasitology*, 64(2), 129–135.
2. Ballard, B. and R. Cheek (2003). *Exotic Animal Medicine for the Veterinary Technician*. Blackwell Publishing, 116–117.
3. Biserkov, V. and T. Genov. (1988). *On the life cycle of Ophiotaenia europaea Odening, 1963 (Cestoda: Ophiotaeniidae)*. *Helminthology (BAS)*, 25, 7–14.
4. Divers, S. and D. Mader. (2005). *Reptile Medicine and Surgery (2nd ed.)*. Saunders Elsevier.
5. Faust, E., W. Sawitz, J. Tobie, V. Odom, C. Peres, D. Lincicome. (1939). *Comparative efficiency of various technics for the diagnosis of protozoa and helminths in feces*. *The Journal of Parasitology*, 25(3), 241–262.
6. Mustafa, S., R. Rafailov, K. Kanchev, C. Koureas, M. Maniotti. (2018). *Study on Internal Parasites in Snakes Grown in Domestic Conditions*. *Tradition and Modernity in Veterinary Medicine*, vol. 3, No 2(5), 55–60.
7. Okulewicz, A., M. Kaźmierczak, K. Zdrzalik. (2014). *Endoparasites of exotic snakes (Ophidia)*. *Helminthologia*, 51, 31–36.
8. Papini, R., C. Manetti, F. Mancianti. (2011). *Coprological survey in pet reptiles in Italy*. *Veterinary Record*, 169(8), 207–210.
9. Raś-Noryńska, M. and R. Sokół. (2015). *Internal parasites of reptiles*. *Annals of Parasitology*, 61(2), 115–117.
10. Rajesh, N., K. Rajesh, M. Jayathangaraj, M. Raman, R. Sridhar. (2015). *Parasitic fauna of captive snakes in Tamilnadu, India*. *Asian Pacific Journal of Tropical Disease*, 5(7), 547–551.
11. Rataj, A., R. Lindtner-Knific, A. Dovč, U. Mavri. (2011). *Parasites in pet reptiles*. *Acta Veterinaria Scandinavica*, 53, 33.
12. Takano, A., D. Morinaga, I. Teramoto, T. Hatabu, Y. Kido, A. Kaneko, T. Hatta, N. Tsuji, S. Uni, K. Sasai, H. Katoh. (2024). *Evaluation of the detection method by a flotation method using a wire loop for gastrointestinal parasites*. *Veterinary Medicine and Science*, 10(5), p.e70007.
13. Warwick, C., C. Steedman, M. Jessop. (2018). *Exotic pet suitability: Understanding some problems and using a labeling system to aid animal welfare, environment, and consumer protection*. *Journal of Veterinary Behavior*, 27, 1–6.
14. Wright, K. (2009). *Differentiation of reptilian parasites and pseudoparasites*. *NAVC Clinician's Brief* 12, 28–32.
15. Wolf, D., M. Vrhovec, K. Failing, C. Rossier, C. Hermosilla, N. Pantchev. (2014). *Diagnosis of gastrointestinal parasites in reptiles: comparison of two coprological methods*. *Acta Veterinaria Scandinavica*, 56, 1–13.