

UNIVERZITET U SARAJEVU - VETERINARSKI FAKULTET



Istraživanje parazita zmija u Bosni i Hercegovini

Završni rad specijalističkog studija “Veterinarska medicina i javno zdravstvo”
Smjer: “Parazitologija i parazitske bolesti”

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Investigation of Snake Parasites in Bosnia and Herzegovina

Diploma Thesis of the Specialist Study Programme “Veterinary Medicine and
Public Health”

Specialization: “Parasitology and Parasitic Diseases”

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SAŽETAK

Zmije mogu biti domaćini različitih grupa parazita, čija učestalost i raznovrsnost zavise od vrste domaćina, porijekla životinje, načina držanja, ishrane, okolišnih uslova te prisustva prelaznih domaćina i vektora. Cilj ovog istraživanja bio je utvrditi prisustvo, raznovrsnost i rasprostranjenost parazita kod slobodnoživućih zmija i zmija koje se drže u zatočeništvu na području Bosne i Hercegovine te procijeniti njihov veterinarski i epidemiološki značaj.

Istraživanjem su obuhvaćene 53 zmije, od kojih su 32 jedinke poticale iz zatočeništva, a 21 iz prirodnih staništa. Uzorci fecesa, krvi, briseva, kože, organa i tkiva prikupljani su tokom 2024. i 2025. godine na različitim lokalitetima u Bosni i Hercegovini. U dijagnostici su korištene koprološke metode flotacije, sedimentacije, OvaTector metoda, direktni razmaz fecesa, bojenje po Ziehl–Neelsenu, direktna imunofluorescencija i komercijalni test za dokazivanje antigena vrste *Giardia duodenalis*. Kod uginulih zmija izvršen je pregled organa, tkiva i tjelesnih šupljina, dok su krvni razmazi, obojeni metodom Giemsa, pregledani radi dokazivanja hemoparazita.

Prisustvo parazita utvrđeno je kod 10 od 53 pregledane jedinke, odnosno ukupan procenat pozitivnih iznosio je 18,86%. Kod slobodnoživućih zmija procenat pozitivnih iznosio je 23,80% (5/21), dok je kod zmija iz zatočeništva procenat pozitivnih iznosio je 15,62% (5/32). Fisherovim egzaktnim testom nije utvrđena statistički značajna razlika između ispitivanih grupa (OR = 0,593; $p = 0,492$). Nematode su bile dominantna grupa parazita i utvrđene su u 70,0% pozitivnih uzoraka. Registrovana su jaja, larve i odrasli oblici gastrointestinalnih nematoda, uključujući nalaze morfološki kompatibilne s rodom *Kalicephalus*. Sporadično su pronađene oociste kokcidija, jedan nalaz suspektan na *Cryptosporidium* spp. te jaja iz porodice Taeniidae, čije prisustvo može predstavljati pseudoparazitizam nakon konzumacije zaraženog plijena.

Rezultati potvrđuju prisustvo različitih grupa parazita kod zmija u Bosni i Hercegovini i ukazuju na dominaciju gastrointestinalnih nematoda. Kombinovanje više dijagnostičkih metoda povećava mogućnost otkrivanja različitih razvojnih stadija parazita, dok su molekularne analize neophodne za pouzdanu identifikaciju pojedinih morfološki suspektih nalaza. Ovo istraživanje predstavlja početni doprinos poznavanju parazitofaune zmija u Bosni i Hercegovini i osnovu za buduća epidemiološka, molekularna i konzervacijska istraživanja.

Ključne riječi: zmije, paraziti, Bosna i Hercegovina, nematode, parazitološka dijagnostika

SUMMARY

Snakes may serve as hosts for various groups of parasites, whose prevalence and diversity depend on the host species, animal origin, husbandry practices, diet, environmental conditions, and the presence of intermediate hosts and vectors. The aim of this study was to determine the presence, diversity, and distribution of parasites in free-ranging and captive snakes in Bosnia and Herzegovina and to assess their veterinary and epidemiological significance.

The study included 53 snakes, of which 32 were kept in captivity and 21 originated from natural habitats. Faecal, blood, swab, skin, organ, and tissue samples were collected during 2024 and 2025 from different localities in Bosnia and Herzegovina. Diagnostic procedures included faecal flotation, sedimentation, the OvaTector method, direct faecal smears, Ziehl–Neelsen staining, direct immunofluorescence, and a commercial test for the detection of *Giardia duodenalis* antigen. In deceased snakes, the organs, tissues, and body cavities were examined, while Giemsa-stained blood smears were analysed for the presence of haemoparasites.

The presence of parasites was detected in 10 out of 53 examined individuals, resulting in an overall positivity rate of 18.86%. In free-ranging (wild) snakes, the percentage of positive individuals was 23.80% (5/21), while in captive snakes, it was 15.62% (5/32). Fisher's exact test revealed no statistically significant difference between the two groups (OR = 0.593; $p = 0.492$). Nematodes were the predominant group of parasites and were detected in 70.0% of all positive samples. Eggs, larvae, and adult stages of gastrointestinal nematodes were identified, including findings morphologically compatible with the genus *Kalicephalus*. Coccidian oocysts were detected sporadically, together with one finding suspected to represent *Cryptosporidium* spp. and one finding of eggs belonging to the family Taeniidae. The latter may represent pseudoparasitism following the ingestion of infected prey.

The results confirm the presence of different parasite groups in snakes in Bosnia and Herzegovina and indicate the predominance of gastrointestinal nematodes. The combined use of several diagnostic methods increases the likelihood of detecting different developmental stages of parasites, whereas molecular analyses are required for the reliable identification of morphologically suspected findings. This study represents an initial contribution to the knowledge of snake parasite fauna in Bosnia and Herzegovina and provides a basis for future epidemiological, molecular, and conservation-oriented investigations.

Keywords: snakes, parasites, Bosnia and Herzegovina, nematodes, parasitological diagnostics