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Helminth Fauna of the Arabian Toad *Sclerophrys arabica* (Heyden, 1827) (Amphibia: Bufonidae) Collected in Sanaa, Yemen

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Abstract: In February 2025, seventeen (10 ♀♀, 7 ♂♂) specimens of the Arabian toad *Sclerophrys arabica* (Heyden, 1827) collected in Sanaa, the capital of Yemen, were helminthologically examined in the Biology Department Laboratory of the Sanaa University. Three helminth species were identified: the cestode species *Nematotaenia dispar* (Goeze, 1782) and the nematode species *Oswaldocruzia arabica* Durette-Desset, Nasher and Ben Slimane, 1992 and *Aplectana brumpti* Travassos, 1931. Among the helminth species found, *A. brumpti* is the first record for *S. arabica*, and *O. arabica* and *A. brumpti* are the first geographical records for Yemen. These findings expand the knowledge on the helminth fauna of *S. arabica* and contribute to knowledge of amphibian helminth fauna in the region.

Key words: *Sclerophrys arabica, Nematotaenia dispar*, *Oswaldocruzia arabica*, *Aplectana brumpti*, Yemen

Introduction

The Arabian toad *Sclerophrys arabica* (Heyden, 1827) (Amphibia: Bufonidae) is an endemic species in the Arabian Peninsula. It exhibits a disjunct distribution: one region covering the coastal strip of the United Arab Emirates and Oman in the northeast and another area in the mountainous and coastal ecosystems of Yemen in the southwest (Fig. 1). Its habitat preferences are around freshwater sources in semi-arid climatic conditions. Because a significant portion of its habitats is situated far away from human settlements, it does not appear to be under threat and is therefore classified as Least Concern by the IUCN. Its regional endemism, limited distribution range and the incomplete knowledge of its parasites make it an important subject for parasitological research.

There are eight species of anurans of four families in Yemen. These are *Firouzophrynus dhufarensis* (Parker, 1931), *Bufo scorteccii* Balletto & Cherchi, 1970, *Sclerophrys arabica* (Heyden, 1827), *S. hadramautinus* (Cherchi, 1963) and *S. tihamica* (Balletto and Cherchi, 1973) (Bufonidae), *Euphlyctis*

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ehrenbergii (Peters, 1863) (Dicroglossidae), *Hyla felixarabica* Gvoždík, Kotlík and Moravec, 2010 (Hylidae) and *Pelophylax ridibundus* (Pallas, 1771) (Ranidae) (see Böhme & Koppetsch 2025). Among them, only *S. arabica* (reported as *Bufo arabicus*) and *E. ehrenbergii* (reported as *Rana cyanophlyctis ehrenbergi*) have been helminthologically examined.

To our knowledge, four helminthological studies have been conducted on *S. arabica* (Fig. 1, Table 1). The first study was carried out in Yemen by Kuntz & Myers (1968). They examined the helminth fauna of vertebrates in the country and addressed two amphibian species: *S. arabica* (recorded as *Bufo orientalis*) and *E. ehrenbergii* (recorded as *Rana cyanophlyctis ehrenbergii*). As a result, *Nematotaenia dispar*, *Aplectana acuminata* (Schrank, 1788), *Aplectana* sp., *Rhabdias bufonis* (Schrank, 1788) and *Centrorhynchus milvus* Ward, 1956 were reported from *S. arabica*. The second study was conducted by Nasher (1979) in Saudi Arabia. It was performed on two frog species: *S. arabica* (recorded as *Bufo orientalis*) and *Hyla felixarabica* (recorded as *Hyla arborea*). As a result, *Polystoma integerrimum*, *Nematotaenia dispar*, *Aplectana* sp., *Oswaldocruzia* sp. and *Rhabdias bufonis* were identified. Later on, Durette-Desset et al. (1992) performed a helminthological examination of *S. arabica* (recorded as *Bufo arabicus*) and described the new nematode species *Oswaldocruzia arabica*. The fourth study was conducted by Kardousha (2002) on *S. arabica* (recorded as *Bufo orientalis*) in the United Arab Emirates and reported *Haemogregarina* sp., *Nematotaenia dispar* and *Rhabdias bufonis*.

Following the long gap between 2002 and 2025, the presented study is the second helminthological survey on *S. arabica* in Yemen and the fifth worldwide.

Materials and Methods

Seventeen specimens of *Sclerophrys arabica* (10 ♀♀ and 7 ♂♂) were collected from the campus of the Sanaa University, Yemen. The specimens were then brought to the Biology Department Laboratory of the Sanaa University for parasitological examination. Before the dissection process, all information about the specimens (collection site, gender, etc.) was recorded. The geographical coordinates of the collection sites were recorded and a study area map was generated using ArcGIS software. For helminthological examination, amphibians were euthanised with an overdose of sodium pentobarbital. Following euthanasia, a complete parasitological dissection was carried out according to the method described by Skryabin (1928). The internal organs were exposed through a longitudinal incision on the ventral side of the body. Under a stereomicroscope, the body cavities of the animals were first examined, then all internal organs were separated from the body and placed in Petri dishes. The inner surface of the animals' bodies was carefully examined, followed by the bladder, heart, liver, oesophagus, stomach and intestines. The parasite species found were stored in 70% ethanol until species identification. In the preparation process, cestode specimens were stained with acetocarmine (Georgiev et al. 1986) and then sealed with Entellan. Permanent preparations of nematode specimens were made by sealing them in lactophenol without any staining process (Garcia 2021).

The identification of parasite species was carried out in accordance with Ryzhikov et al. (1980) and Durette-Desset et al. (1992). Prevalence, mean intensity and mean abundance values were calculated according to (Bush et al. 1997). The identified helminth specimens were stored in the Biology Laboratory of Sanaa University.

Results

Three helminth species were identified in the individuals of *Sclerophrys arabica* examined in the study. These were one cestode species (*Nematotaenia dispar*) and two nematode species (*Oswaldocruzia arabica* and *Aplectana brumpti*).

Cestoda

Nematotaeniidae

***Nematotaenia dispar* (Goeze, 1782) Lühe, 1899 (Fig. 2)**

Syn. *Taenia dispar* Goeze, 1782; *Taenia bufonis* Gmelin, 1790; *Halysis obvoluta* Zeder, 1803; *Nematotaenia kashmirensis* Fotedar, 1966; *Nematotaenia dollfusi* Yuen & Fernando, 1974; *Nematotaenia viride* Mokhtar-Maamouri & Chakroun, 1984

Prevalence: 13/17 (76.5%).

Mean intensity: 9.8.

Mean abundance and range of intensity: 7.5; 1–37.

Site of infection and number of infected specimens: Intestine, 13 host specimens.

Type host and type locality: Unidentified toad, Germany (Goeze, 1782).

Remarks: *Nematotaenia dispar* is reported from Yemen for the second time. It is observed in *S. arabica* for the fourth time. This species has been recorded from numerous amphibian hosts, particularly of the genera *Bufo, Rana*, *Hyla*, *Mertensiella* and *Salamandra*, which indicates a wide host range

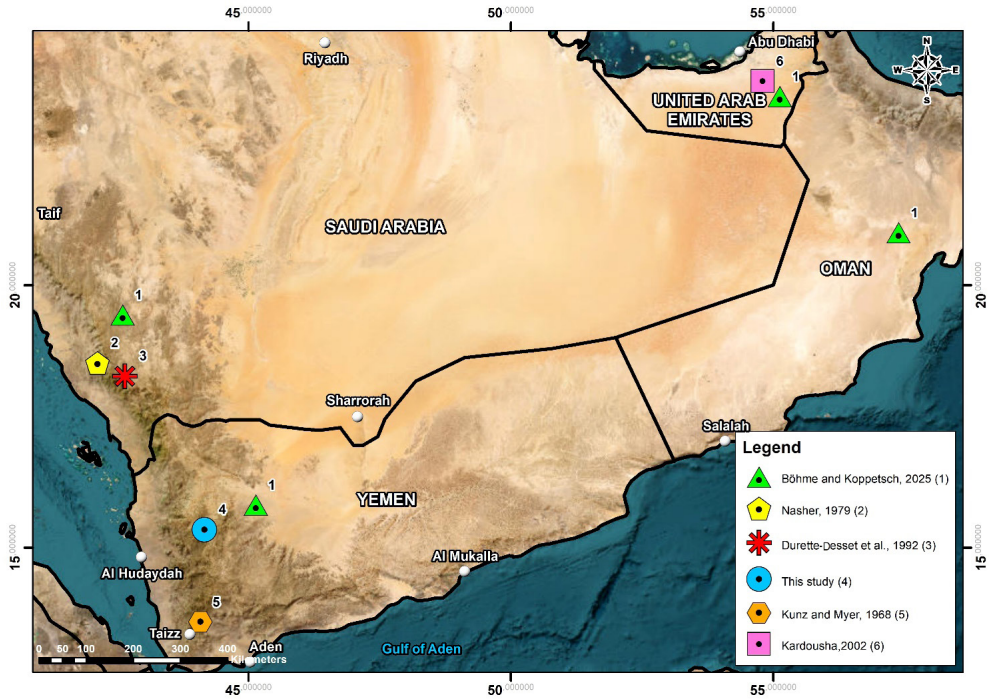


Fig. 1. Geographical distribution of *Sclerophrys arabica* and locations of helminthological studies conducted on this species.

Table 1. Records of helminth species reported from *Sclerophrys arabica* in different countries.

Helminths	Kuntz & Myers (1968) Yemen	Nasher (1979) Saudi Arabia	Durette-Desset et al. (1992) Saudi Arabia	Kardousha (2002) United Arab Emirates and Qatar	Present study Yemen
Haemogregarina sp.				*	
Polystoma integerrimum		*			
Nematotaenia dispar	*	*		*	*
Oswaldocruzia sp.		*			
Oswaldocruzia arabica			*		*
Aplectana acuminata	*				
Aplectana brumpti					*
Aplectana sp.	*	*			
Rhabdias bufonis	*	*		*	
Centrorhynchus milvus	*				

(Frölich 1789; Prudhoe & Bray 1982; Jones 1987; Goldberg & Bursey 2002; Yıldırımhan et al. 2005; Saeed et al. 2007; Okulewicz et al. 2014).

Geographic range: Oriental, Nearctic and Palaearctic realms (Jones, 1987).

Nematoda

Trichostrongylidae

***Oswaldocruzia arabica* Durette-Desset, Nasher & Ben Slimane, 1992 (Fig. 3)**

Prevalence: 2/17 (11.8%)

Mean intensity: 4.0

Mean abundance and range of intensity: 0.5; 3–5.

Site of infection and number of infected specimens: Intestine, two host specimens.

Type host and type locality: *Sclerophrys arabica*, Saudi Arabia (Durette-Desset et al. 1992).

Remarks: The present study is the first record of *Oswaldocruzia arabica* from Yemen. This is the second record of *O. arabica* worldwide.

Geographic range: It has been found on the Arabian Peninsula only – Saudi Arabia (Durette-Desset et al. 1992) and Yemen (present study).

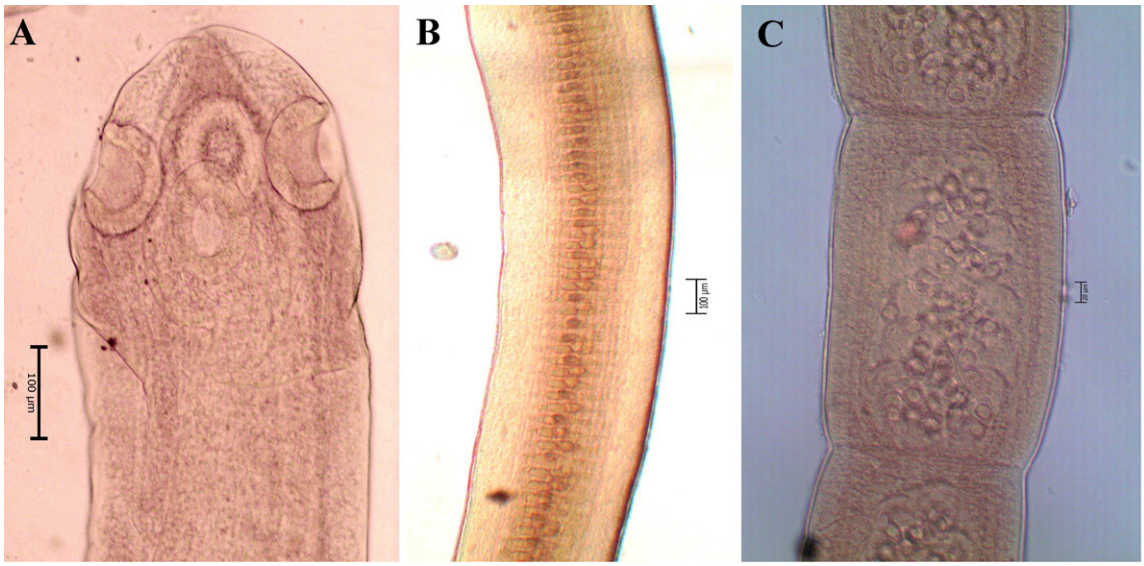


Fig. 2. Light micrographs of *Nematotaenia dispar*. A. Scolex. B. General view of mature proglottides. C. Pregravid proglottides.

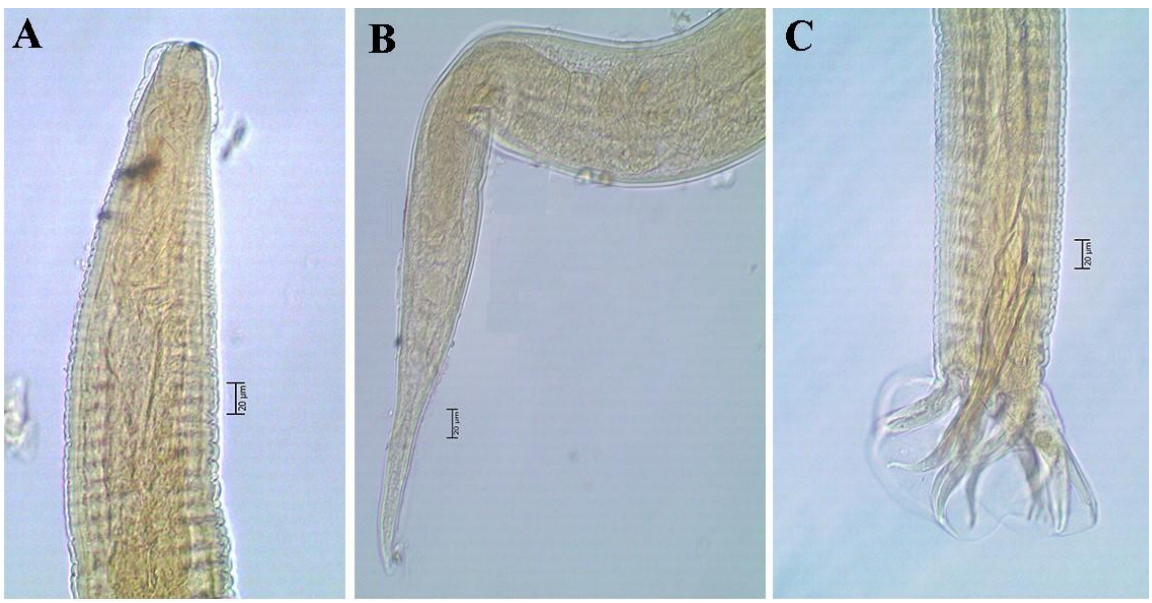


Fig. 3. Light micrographs of *Oswaldocruzia arabica*. A. Anterior end. B. Posterior end of a female. C. Posterior end of a male.

Cosmocercidae

***Aplectana brumpti* Travassos, 1931 (Fig. 4)**

Syn: *Paraplectana brumpti* (Travassos, 1931); *Aplectana miranda* Ivanitzky, 1940; *Aplectana corti* Lopez-Neyra, 1947; *Aplectana ivanitzkyi* Markov, Khonyakina & Grivor'eva, 1972

Prevalence: 11/17 (64.7%)

Mean intensity: 12.4

Mean abundance and range of intensity: 8.1; 2–28.

Site of infection and number of infected specimens: Intestine, 11 host specimens.

Type host and type locality: *Pseudepidalea viridis*, Corsica, France (Travassos 1931).

Remarks: In the present study, *Aplectana brumpti* has been recorded for the first time from Yemen and from *Sclerophrys arabica.* Records in the world: *Pelophylax ridibundus* (Ivanitzky 1940), *Pseudepidalea viridis* (Travassos 1931; Lopez-Neyra 1947; Kozlowska 1960; Kozák 1969; Frandsen 1974; Baker 1980), *Rana temporaria* (Ivanitzky 1940), *P. viridis, Pelobates syriacus* (Schad et al. 1960), *Natrix natrix, Natrix tessellata* (Markov et al. 1962), *Bufo bufo* (Fernández et al. 1987), *Epi-*

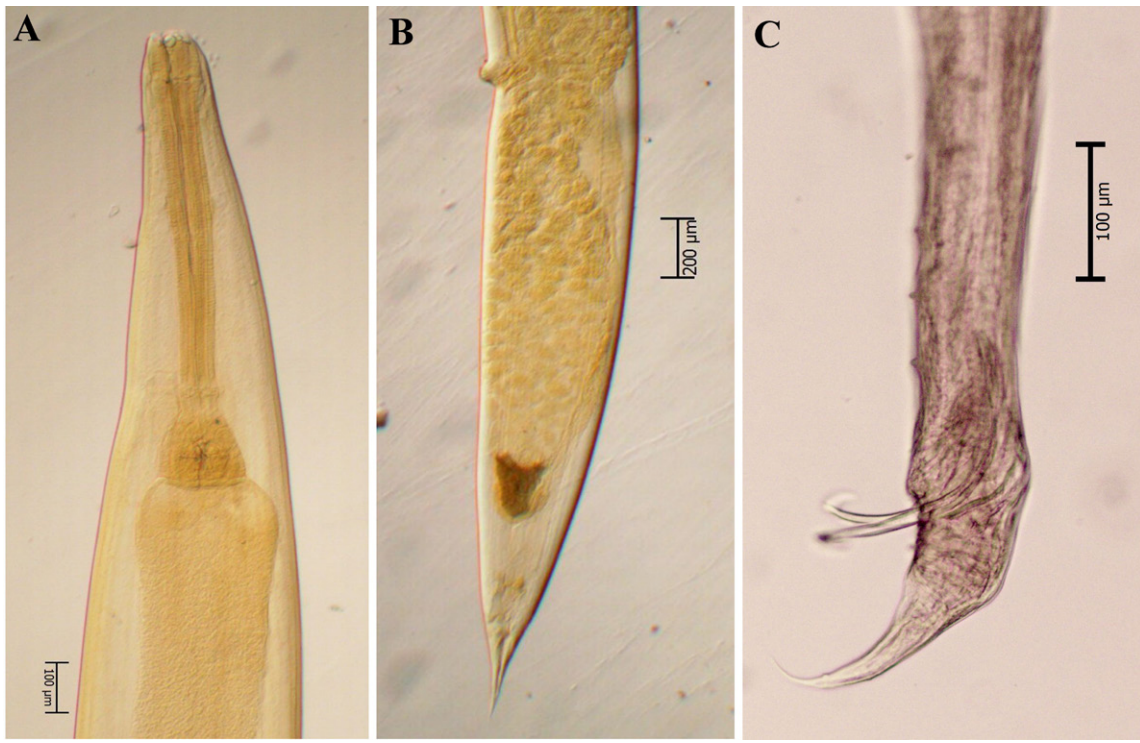


Fig. 4. Light micrographs of *Aplectana brumpti*. A. Anterior part. B. Posterior end of a female. C. Posterior end of a male.

dalea calamita (Fernández et al. 1987), *Pelodytes caucasicus* (Yıldırımhan et al. 2009), *Pelobates syriacus* (Yıldırımhan & Bursey 2010), *Hyla savignyi* (Yıldırımhan et al. 2012).

Geographic range: Western (Baker 1980) and South-eastern Europe (Ivanitzky 1940; Markov et al. 1962), Türkiye (Yıldırımhan et al. 2009, 2012, Yıldırımhan & Bursey 2010).

Discussion

In the course of the present study, three helminth species infecting *Sclerophrys arabica* were identified. A total of 267 helminth specimens (122 *Nematotaenia dispar*, 8 *Oswaldocruzia arabica*, and 137 *Aplectana brumpti*) were found in the 17 examined individuals. All the helminth parasites were collected from the small intestine. Helminths were detected in 15 individuals (88.2%) of *S. arabica*. Among the infected individuals, 5 had only 1 helminth species, 9 had 2 species, and 1 had 3 species of coexisting helminths. The mean number of helminth species per infected host was 1.52 (SD = 0.79), while the mean intensity was 18.13 individuals (SD = 10.2).

Among the helminth species identified, *Nematotaenia dispar* has the highest prevalence. This species has been recorded as a parasite primarily in amphibians, rarely in reptiles (Prudhoe & Bray 1982). *Oswaldocruzia arabica* showed the lowest prevalence, intensity and abundance. In contrast, *Aplectana brumpti* has the highest intensity value. This species was first reported from *Pseudepidalea viridis* on the Island of Corsica, France (Travassos 1931). In this study, it has been reported for the first time from *S. arabica* (new host record).

The summarised data on the helminth parasites of *S. arabica* on the Arabian Peninsula (Table 1) show that *Nematotaenia dispar*, *Aplectana acuminata, Rhabdias bufonis* and *Centrorhynchus milvus* have been reported in Yemen. Studies in Saudi Arabia have recorded *N. dispar*, *Aplectana* sp., *Rhabdias bufonis* and *Polystoma integerrimum* as well as a new species (*Oswaldocruzia arabica*), which is now confirmed. Research conducted in the United Arab Emirates and Qatar has reported *N. dispar* and *R. bufonis*, along with a protozoan parasite (*Haemogregarina* sp.). These comparisons reveal that *N. dispar* is the most common helminth species, while *A. brumpti* presents a new record for *S. arabica* (Table 1).

Regional species differences are thought to arise from ecological conditions, host species composition and sampling timing. Yemen is located in the semiarid and arid tropical climate zone and is divided into three distinct ecological regions: the coastal plain, the western Sarawat Mountains, and the eastern plateaus (Republic of Yemen 2013). This ecological diversity may influence the habitat pref-

erences of amphibians and, consequently, the distribution of the helminth species.

Helminthological studies conducted on amphibians in Yemen are quite limited. The new findings indicate that the parasite fauna of amphibians in this region has not been adequately examined and host-parasite relationships have not been comprehensively elucidated. This situation leads to a lack of information about the parasite communities and host-parasite relationships in the region. Filling the existing gap will not only more accurately reveal the diversity of Yemen's amphibian helminth fauna but will also allow us to understand the effects of these parasites on the ecosystem as well as their infectious potential. Therefore, more comprehensive data on biodiversity and ecological interactions in the region are needed.

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