

Research Note

A contribution to the nematode fauna of two agamid lizards from Afghanistan

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Summary

Information on the recent herpetological and related parasitological collections are very rarely available for Afghanistan. We examined two species of the family Agamidae, *Laudakia nuristanica* and *Paralaudakia caucasia* for the presence of the intestinal helminth fauna. Overall, we examined 13 specimens of these lizards and found three species of helminths (*Abbreviata achari*, *Thelandros masaae*, *T. taylori*) in a single specimen of *L. nuristanica* and four species (*A. achari*, *T. baylisi*, *T. taylori*, *P. kasauli*) in three specimens of *P. caucasia*. Here in, we present the first report on the helminth fauna from *L. nuristanica*, record a new helminth host for *P. caucasia* and three new country records for the helminth fauna of Afghanistan.

Keywords: Agamidae; Central Asia; first records; Palearctic; endoparasites; rare collection

Introduction

Afghanistan is a country situated between two main biogeographical realms, the Palearctic and Oriental (Wagner *et al.*, 2016; Jablonski *et al.*, 2019b). Due to the political instability in Afghanistan for the past 40 years, studies in the field of zoology are rarely seen. However, during the so-called "Golden Age" starting in 1930s of the 20th Century and ending in the mid-1970s, the herpetological field research increased in the country, resulting in the majority of current knowledge (Wagner *et al.*, 2016; Jablonski *et al.*, 2019a). The same is true for parasites related research on amphibians and reptiles of Afghanistan (Chatterji, 1935; Akhtar, 1939; Baruš *et al.*, 1970, 1972; Baruš & Tenora, 1976; Baker, 1987). However, since those times we have only limited new herpetologically related data from the country (Jablonski *et al.*, 2019b). The herpetofauna of Afghanistan currently contains 117 species, with the most species recorded in the family Agamidae (26 taxa; Wagner *et al.*, 2016; Jablonski *et al.*, 2019b). This family is represented in Afghanistan by common, widely distributed species, as well as local endemics.

We examined specimens of two recently collected members of the Agamidae from Afghanistan, *Laudakia nuristanica* (Anderson & Leviton, 1969) and *Paralaudakia caucasia* (Eichwald, 1831), for helminth parasites.

Laudakia nuristanica, described from the Nuristan Province in Afghanistan, is an endemic species for eastern part of the Hindu Kush range, and is currently known from the eastern Afghanistan and northwestern Pakistan (Chitral District; Sindaco & Jeremčenko, 2008; Baig *et al.*, 2012). On the other hand, *P. caucasia* is, besides Afghanistan, known from eastern and southern Georgia, Armenia, Azerbaijan, Dagestan, southern Turkmenistan, north-eastern Turkey, Iran, Iraq, and northwestern Pakistan (Szczerbak, 2003; Sindaco & Jeremčenko, 2008). Whereas nematode parasites of *P. caucasia* were previously studied in different countries of the species range (e.g. Goldberg *et al.*, 2003; Yildirimhan *et al.*, 2006; Molavi *et al.*, 2018, see Tab. 1), nothing is known about the helminths of *P. caucasia* from Afghanistan. Moreover, there are no published helminth records for *L. nuristanica*, and we therefore establish the helminth list for this latter species.

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Table 1. An overview of the helminths recorded in *Paralauakia caucasica*.

| Species | Family | Region or country | Used hosts taxonomy | References |
|--|------------------|------------------------------|------------------------------|----------------------------------|
| <i>Oochoristica tuberculata</i> (Rudolphi, 1819) | Anoplocephalidae | Turkey | <i>Paralauakia caucasica</i> | Yildirimhan <i>et al.</i> (2006) |
| <i>Abbreviata achari</i> (Mirza, 1935) | Physalopteridae | Pakistan | <i>Calotes versicolor</i> | Goldberg <i>et al.</i> (2003) |
| <i>Abbreviata uzbekistanica</i> Bogdanov and Markov, 1955 | Physalopteridae | Central Asia | <i>Paralauakia caucasica</i> | Andrusko and Markov (1956) |
| <i>Abbreviata uzbekistanica</i> Bogdanov and Markov, 1955 | Physalopteridae | Turkmenistan | <i>Paralauakia caucasica</i> | Bogdanov and Markov (1955) |
| <i>Foleyella candezei</i> (Fraipoint, 1882) Seurat, 1917 | Onchocercidae | Central Asia | <i>Paralauakia caucasica</i> | Sharpilo (1976) |
| <i>Foleyella candezei</i> (Fraipoint, 1882) Seurat, 1917 | Onchocercidae | Turkey | <i>Paralauakia caucasica</i> | Yildirimhan <i>et al.</i> (2006) |
| <i>Oswaldofilaria chlamydosauri</i> Breinl, 1912 | Onchocercidae | Iran | <i>Paralauakia caucasica</i> | Molavi <i>et al.</i> (2018) |
| <i>Oxyuris cincta</i> Linstow, 1897 = <i>Thelandros inquirendum</i> | Pharyngodonidae | Transcaucasia | <i>Agama caucasica</i> | Sharpilo (1962) |
| <i>Parapharyngodon dogieli</i> Markov and Bogdanov, 1965 | Pharyngodonidae | Central Asian SSR | <i>Agama caucasica</i> | Sharpilo (1976) |
| <i>Parapharyngodon kasauli</i> (Chatterji, 1935) Markov and Bogdanov, 1965 | Pharyngodonidae | Central Asian SSR | <i>Agama caucasica</i> | Sharpilo (1976) |
| <i>Parapharyngodon szzerbaki</i> Radchenko and Shapito, 1975 | Pharyngodonidae | Central Asian SSR | <i>Agama caucasica</i> | Sharpilo (1976) |
| <i>Parapharyngodon tyche</i> Sulahian and Schacher, 1968 | Pharyngodonidae | Turkey | <i>Laudakia caucasica</i> | Yildirimhan <i>et al.</i> (2006) |
| <i>Saurosifus agamae agamae</i> Macfie, 1924 | Onchocercidae | USSR | <i>Agama caucasica</i> | Sharpilo (1976) |
| <i>Skrijabinodon pigmentatus</i> (Markov and Bogdanov, 1961) Baruš and Coy Otero, 1974 | Pharyngodonidae | Iran | <i>Laudakia caucasica</i> | Rezazadeh <i>et al.</i> (2012) |
| <i>Spauligodon lacerate</i> Sharpilo, 1966 | Pharyngodonidae | Iran | <i>Laudakia caucasica</i> | Rezazadeh <i>et al.</i> (2012) |
| <i>Thelandros baylisi</i> (Chatterji, 1935) Fetter, 1966 | Pharyngodonidae | Iran | <i>Laudakia caucasica</i> | Rezazadeh <i>et al.</i> (2012) |
| <i>Thelandros markovi</i> Radchenko and Sharpilo, 1975 | Pharyngodonidae | Central Asian SSR | <i>Agama caucasica</i> | Radchenko and Sharpilo (1975) |
| <i>Thelandros markovi</i> Radchenko and Sharpilo, 1975 | Pharyngodonidae | Central Asian SSR | <i>Agama caucasica</i> | Sharpilo (1976) |
| <i>Thelandros popovi</i> Markov and Bogdanov, 1963 | Pharyngodonidae | Central Asian SSR | <i>Agama caucasica</i> | Sharpilo (1976) |
| <i>Thelandros szzerbaki</i> Radchenko and Sharpilo, 1975 | Pharyngodonidae | Turkistan and Caucasus, USSR | <i>Agama caucasica</i> | Radchenko and Sharpilo (1975) |
| <i>Thubunaea baylisi</i> Akhtar, 1939 | Physalopteridae | Central Asian SSR | <i>Agama caucasica</i> | Sharpilo (1976) |
| <i>Thubunaea baylisi</i> Akhtar, 1939 | Physalopteridae | Turkey | <i>Laudakia caucasica</i> | Yildirimhan <i>et al.</i> (2006) |

Materials and Methods

We found nematodes in four specimens: one adult female of *L. nuristanica* (DJ8013 [nematodes] = Pakistan Museum of Natural History (PMNH) 4353 [host]) collected on 14 August 2018 at Saiad (34.9995°N, 69.3305°E, WGS84, 1,478 m elevation), Bagram District, Parwan Province, Afghanistan; one adult female of *P. caucasica* (DJ8011 = PMNH 4411) collected on 13 August 2018 at Chaikal (34.8968°N, 69.1445°E, WGS84, 1,585 m elevation), Parwan Province, Afghanistan; one adult female of *P. caucasica* (DJ8016 = PMNH 4410) collected on 15 August 2018 at Maymana, (35.9343°N, 64.7812°E, WGS84, 859 elevation) Faryab Province, Afghanistan; and one subadult male of *P. caucasica* (DJ8019 = PMNH 4412) collected on 13 August 2018 in Samarbagh (34.8359°N, 69.0755°E, WGS84, 1,930 m elevation), Parwan Province, Afghanistan. All these specimens were collected by hand. The specimens of lizards were euthanized, preserved in 10 % formalin, maintained in 70 % ethanol and utilized in helminthological examination. The lizards were identified using identification keys in Anderson and Leviton (1969) and Baig *et al.* (2012). Overall, we examined 13 specimens of these lizards (seven of *L. nuristanica*, six of *P. caucasica*) and deposited them in the herpetological collection of Pakistani Museum of Natural History (PMNH), Islamabad, Pakistan under the voucher numbers PMNH 4346-4347, 4349-4353 (*L. nuristanica*) and 4410-4415 (*P. caucasica*). All other examined specimens (9) were without helminth parasites. The research related to animals complied with all the relevant national regulations and institutional policies for the care and use of animals.

The helminthological examination proceeded as follows: the body cavity of examined lizards was opened by a longitudinal incision and the digestive tract was removed and opened. The esophagus, stomach and small and large intestine were examined for helminths utilizing a dissecting microscope. Found nematodes were placed on a glass slide in a drop of lactophenol, a cover slip was added and identifications were made from these temporary wet mounts. The nematodes were preserved in 96 % ethanol, maintained in 70 % ethanol and deposited in the collection of the first author at the Department of Zoology, Comenius University in Bratislava, Slovakia. This collection was subsequently provided to the Harold W. Manter Parasitology Laboratory (HWML), The University of Nebraska, Lincoln, Nebraska, USA. Identifications of nematodes made utilizing Anderson *et al.* (2009), Gibbons (2010) and comparisons to the original descriptions in Mirza (1935), Chatterji (1935), Adamson and Nasher (1984).

Results and Discussion

In *L. nuristanica*, we found one *Abbreviata achari* (Mirza, 1935) (family Physalopteridae), two *Thelandros masaae* Adamson and Nasher, 1984 (family Pharyngodonidae) and six *Thelandros taylori* (Chatterji, 1935). *Abbreviata achari*, was originally described from

Calotes versicolor (Daudin, 1802) collected in India (Mirza, 1935), and is also known from *Paralaudakia caucasica* and *Trapelus agilis* (Olivier, 1807) from Pakistan (Goldberg *et al.*, 2003). *Thelandros masaae* was originally described from *Acanthocercus yemenensis* (Klausewitz, 1954) of Saudi Arabia (Adamson & Nasher, 1984) and is also known from *Acanthodactylus cantoris* Günther, 1864 and *Laudakia nupta* from Pakistan (Goldberg *et al.*, 2003). *Thelandros taylori* was originally described from *Saara hardwickii* (Gray, 1827) collected in India and Afghanistan (Chatterji, 1935) and has also been reported from *Laudakia nupta* (De Filippi, 1843) from Pakistan (Goldberg *et al.*, 2003), *Laudakia tuberculata* (Gray, 1827) from India, Turkmenistan and Afghanistan (Goldberg *et al.*, 2003), *Laudakia stellio* (Linnaeus, 1758) from Turkey (Yildirimhan *et al.*, 2006), and *Paralaudakia himalayana* (Steindachner, 1867) from Turkmenistan (Baker, 1987). Voucher helminths were deposited in the Harold W. Manter Parasitology Laboratory (HWML), The University of Nebraska, Lincoln Nebraska as *Abbreviata achari*, (HWML 110809), *Thelandros masaae* (HWML 110810) and *Thelandros taylori* (HWML 110811). *Laudakia nuristanica* represents a new host record for *Abbreviata achari*, *Thelandros masaae* and *T. taylori*. *Thelandros masaae* and *T. taylori* represents new country records for Afghanistan.

In *P. caucasica*, four nematodes species were found. One specimen of *Abbreviata achari* was found in DJ8011; 27 specimens of *Thelandros baylisi* (Chatterji, 1935), 20 specimens of *T. taylori* and two *Parapharyngodon kasauli* (Chatterji, 1935) (family Pharyngodonidae) were found in DJ8016; 93 specimens of *T. taylori* were found in DJ8019. Previous reports of helminths in *P. caucasica* are summarized in Table 1. Voucher specimens of *Thelandros taylori* were deposited as (HWML 110812). *Thelandros taylori* in *P. caucasica* is a new host record. Afghanistan is a new country record for *A. achari*.

Of the nine genera of Nematoda reported to occur in *P. caucasica*, four of them are monoxenous (no intermediate host): *Oxyuris*, *Parapharyngodon*, *Spauligodon* and *Thelandros* and five are heteroxenous (utilize intermediate host): *Abbreviata*, *Foleyella*, *Oswaldofilaria*, *Saurositus* and *Skrjabinodon* (Anderson, 2000). The one species of *Cestoda*, *Oochoristica* is heteroxenous (Conn, 1985). This indicates infection by helminths utilizing different life cycles. None of the helminths found in either *P. caucasica* or *L. nuristanica* were restricted to either species. Each of these helminths infected other hosts indicating that these are generalist helminths. In conclusion, it appears that the occurrence of a particular helminth in a lizard species is the result of chance, reflecting opportunistic feeding habits and the availability of food of appropriate size, rather than phylogenetic affinities. As additional lizards from Afghanistan are examined for parasites, we expect the helminth lists for these lizards will grow.

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Conflict of Interest

Authors state no conflict of interest.

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