

Nematode parasites of the two limbless lizards: Turkish worm lizard, *Blanus strauchi* (Bedriaga, 1884) (Squamata: Amphisbaenidae), and slow worm, *Anguis fragilis* Linnaeus 1758 (Squamata: Anguidae), from Turkey

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Summary

In this investigation, seventeen Turkish worm lizards, *Blanus strauchi*, and eighteen slow worms, *Anguis fragilis*, collected from Turkey, were examined for helminths. *Blanus strauchi* harbored 2 species of Nematoda: *Pharyngodon spinicauda* and *Aplectana* sp. (larvae); *Anguis fragilis* harbored 5 species of Nematoda: *Rhabdias bufonis*, *Entomelas entomelas*, *Oswaldocruzia filiformis*, *Cosmocerca ornata* and *Oxysomatium brevicaudatum*. *Blanus strauchi* represents a new host record for *Pharyngodon spinicauda* and *Aplectana* sp. *Anguis fragilis*, represents a new host record for *Cosmocerca ornata*. Turkey is a new locality record for *Pharyngodon spinicauda*.

Keywords: *Anguis fragilis*; *Blanus strauchi*; Nematoda; slow worm; Turkish worm lizard; Turkey

Introduction

The helminth parasites of two limbless lizards, Turkish worm lizard, *Blanus strauchi*, and slow worm, *Anguis fragilis*, were examined. Only nematodes observed, other helminths were also searched but not they observed in this study.

The Turkish worm lizard, *B. strauchi*, externally resembling an earthworm, it lives under the stones or in soil within sparsely vegetated bushy areas and is sometimes seen within or at the edges of woods. It feeds on insects. *Blanus strauchi* inhabits some Aegean islands, Turkey, Syria and Northern Iraq, with a vertical distribution to 1400 m (Baran and Atatür, 1998). The slow worm, *A. fragilis*, inhabits grassy meadows, woodlands, maquis (a scrubland vegetation of the Mediterranean region) and similar richly vegetated areas with good ground cover and usually hides under stones or inside burrows in loose soil. It feeds on soft bodied invertebrates and insects. It is widely distributed in the majority of Europe and west Asia, with a vertical distribution to 2400 m (Baran and Atatür,

1998).

To our knowledge no helminthological reports have been published for *B. strauchi*; however one study of helminths for *A. fragilis* (Schad *et al.*, 1960) in Turkey exists.

This is the first helminthological study for *B. strauchi* and second helminthological study for *A. fragilis* from Turkey.

Materials and Methods

B. strauchi were collected by hand between 1997 and 2007, from 5 localities in southern Turkey: Büyükçaltıcak, Antalya Province, 10 m elevation (36° 46' N; 30° 34' E), Hisarçandır, Antalya Province 1000 m elevation (36° 44' N; 30° 26' E); Üzümlü-Fethiye, Muğla Province, 1000 m elevation (36° 48' N; 29° 11' E); Pamukkale University Campus, Denizli Province, 400 m elevation (37° 44' N; 29° 06' E) and Samandağ, Hatay province, 450 m elevation (36° 09' N; 35° 58' E). In total, 17 *B. strauchi* (9 males, 8 females) were examined for helminth parasites. The mean ± SD snout-vent length (SVL) of specimens was 17.52 ± 2.59 cm, with a range from 11.0 to 20.5 cm.

A. fragilis were collected by hand at 4 localities in north-western Turkey, between 1998 and 2005: Altınoluk, Balıkesir Province, 200 m elevation (39° 48' N; 27° 12' E), Uludağ, Bursa Province 1200 m elevation (40° 06' N; 29° 07' E), Akyazı, Sakarya Province, 200 m elevation (40° 41' N; 30° 38' E), Akçakoca, Düzce Province, 150 m elevation (41° 05' N; 31° 07' E). In total, 18 *A. fragilis* (8 males, 7 females and 3 juveniles) were examined for helminth parasites. The mean ± SD snout-vent length (SVL) of specimens was 24.03 ± 6.26 cm, with a range from 14.1 to 35.0 cm.

The body cavity was opened by a longitudinal ventral incision. The alimentary canal was excised and separated into stomach, small intestine, large intestine and rectum. The contents of each part and other organs (lungs, liver, gall bladder, kidneys) were each mixed with 0.5 % saline

Table 1. Nematode parasites of *Blanus strauchi* and *Anguis fragilis* from Turkey

| Parasite (ZDEU Helm. Coll. no.) | Host | Developmental Stage | Site of Infection | No. of Infected (%) | Mean Intensity (\pm SE) | Range |
|---|--------------------|---------------------|-------------------|---------------------|----------------------------|--------|
| RHABDIASIDAE | | | | | | |
| <i>Rhabdias bufonis</i> (Schrank, 1788) Stiles and Hassall, 1905 (ZDEU HELM-1/2008) | <i>A. fragilis</i> | Adult | LU | 8 (44.4 %) | 3.4 (\pm 2.6) | 1 – 9 |
| <i>Entomelas entomelas</i> (Dujardin, 1845) (ZDEU HELM-2/2008) | <i>A. fragilis</i> | Adult | LU | 8 (44.4 %) | 3.6 (\pm 3.2) | 1 – 9 |
| MOLINEIDAE | | | | | | |
| <i>Oswaldocruzia filiformis</i> (Goeze, 1782) Travassos, 1917 (ZDEU HELM-3/2008) | <i>A. fragilis</i> | Adult | SI | 4 (22.2 %) | 6.8 (\pm 6.2) | 1 – 14 |
| COSMOCERCIDAE | | | | | | |
| <i>Pharyngodon spinicauda</i> (Dujardin, 1845) (ZDEU HELM-4/2008) | <i>B. strauchi</i> | Adult | LI | 9 (52.94 %) | 2.2 (\pm 1.6) | 1 – 6 |
| <i>Cosmocerca ornata</i> (Dujardin, 1845) (ZDEU HELM-5/2008) | <i>A. fragilis</i> | Adult | SI, LI | 9 (50 %) | 3.1 (\pm 1.7) | 1 – 6 |
| <i>Aplectana</i> sp. (ZDEU HELM-6/2008) | <i>B. strauchi</i> | Larvae | SI, LI | 11 (64.7 %) | 24.3 (\pm 19.8) | 2 – 60 |
| <i>Oxysomatium brevicaudatum</i> (Zeder, 1800) Railliet and Henry, 1916 (ZDEU HELM-7/2008) | <i>A. fragilis</i> | Adult | SI | 15 (83.3 %) | 3.1 (\pm 2.1) | 1 – 8 |

SI - small intestine; LI - large intestine; LU - lung

solution and poured into petri dishes for examination under a stereomicroscope. The muscles, plus portions of peritoneum and spinal cord, were teased out with needles and examined under a stereomicroscope. Nematodes were straightened by heat, fixed, and stored in 70 % ethanol with 5 % glycerol. Intensities are presented as mean values (\pm SD) followed by the range. Voucher specimens of parasites were deposited in the Ege University, Museum of Zoology, Izmir, Turkey (ZDEU HELM 1-7/2008); host specimens were deposited in the Uludağ University, Department of Biology, Bursa Turkey.

Results and Discussion

In summary, 287 individuals of 2 helminth species were collected from 17 *B. trauchi* examined. Nematodes were observed in the large and small intestine, no helminths were observed in lungs of this species: 12 (70.6 %) individuals of *B. trauchi* examined harbored one or two nematode species in each individual the remaining 5 (29.4 %) were uninfected. There were 1.66 ± 0.49 helminth species per infected host.

Eighteen *A. fragilis* were examined, 162 individuals of 5 helminth species were collected. Nematodes were recorded the lungs, large and small intestine of this species. No individual host harbored more than 4 helminth species. Of the infected lizards, 2 (11.1 %) harbored 4 species of helminth, 6 (33.3 %) harbored 3 species of helminth, 7 (38.9 %) harbored 2 species of helminth and 3 (16.7 %), harbored 1 species of helminth. There were 2.3 ± 0.96 helminth species per infected host and 9 ± 7.32 helminth individuals per infected host. Data on nematode infections of *Blanus trauchi* and *Anguis fragilis* are recorded in Table 1.

This is the first published study of helminths of *B. trauchi* from Turkey. *B. trauchi* represents a new host record for each of the collected parasite species (*Pharyngodon spini-*

cauda and *Aplectana* sp.) in Turkey. *Pharyngodon spini-cauda* was recorded various reptile and amphibian hosts in Europe (*Lacerta*, *Ameiva*, *Ptychodactylus*, *Triton* and *Triturus*) (Yamaguti, 1961). Four *Aplectana* species were reported from various amphibians in Turkey: *Aplectana brumptii* was recorded from Green toad (*Bufo viridis*) and Eastern spadefoot toad (*Pelobates syriacus*) by Schad *et al.* (1960) and Yıldırımhan and Bursey (2010), similarly Schad *et al.* (1960) reported *Aplectana schneideri* from *Bufo regularis* (probably *Bufo viridis*). *Aplectana acuminata* observed in Caucasian Salamander (*Mertensiella caucasica*), Luschan's Salamander (*Lyciasalamandra billae*) and common toad (*Bufo bufo*) (Yıldırımhan *et al.*, 2005b; Yıldırımhan and Öz, 2008; Yıldırımhan and Karadeniz, 2007a). *Aplectana macintoshii* recorded in *Bufo bufo* (Yıldırımhan and Karadeniz, 2007a). No reptile host records about *Aplectana* sp. in Turkey.

Schad *et al.* (1960) published an annotated list about some Turkish vertebrates. They recorded *Entomelas entomelas*, *E. dujardini*, *Oswaldocruzia skrjabini* and *Oxysomatium brevicaudatum* from *Anguis fragilis* in Turkey.

E. entomelas is a commonly observed nematode species for *A. fragilis* in Europe (Yamaguti, 1961). Baker (1980) redescribed the genus *Entomelas* specimens from *A. fragilis* and *Ophisaurus apodus*. He emended the generic diagnosis of *Entomelas*. *E. dujardini* is synonymized with *E. entomelas*. Schad *et al.* (1960) reported two species of *Entomelas* from *A. fragilis* (*E. entomelas* and *E. dujardini*), however, Baker (1980) accepted *E. dujardini* is synonym of *E. entomelas*, in this situation only *E. entomelas* distributing in Turkey.

The genera *Paraentomelas*, *Hexadontophorus* and *Kurilonema* were synonymized with *Entomelas*. According to Anderson (2000), *E. entomelas* probably invaded snails and earthworms which serve as paratenic hosts, which could serve as the route of infection for *A. fragilis* in this study.

Table 2. The infection data comparison of *A. fragilis*

| Helminth Name | N | Number of infected hosts | Prevalence (%) | Mean intensity | Range | Reference |
|----------------------------------|----|--------------------------|----------------|----------------|--------|-------------------------------|
| <i>Entomelas entomelas</i> | 9 | 1 | 11.11 | - | - | Schad <i>et al.</i> , 1960 |
| | 2 | 1 | 50 | 3.00 | - | Mihalca <i>et al.</i> , 2007 |
| | 19 | 1 | 5.26 | - | 1 | Shimalov <i>et al.</i> , 2000 |
| | 18 | 8 | 44.4 | 3.6 | 1-9 | In this study |
| <i>Oswaldocruzia fliformis</i> | 7 | 1 | 14.28 | - | 1 – 2 | Borkovcová & Kopřiva, 2005 |
| | 19 | 2 | 10.52 | - | 1 | Shimalov <i>et al.</i> , 2000 |
| | 18 | 4 | 22.2 | 6.8 | 1 – 14 | In this study |
| <i>Cosmocerca ornata</i> | 19 | 1 | 5.26 | - | 1 | Shimalov <i>et al.</i> , 2000 |
| | 18 | 9 | 50 | 3.1 | 1 – 6 | In this study |
| <i>Oxysomatium brevicaudatum</i> | 9 | 1 | 11.11 | - | - | Schad <i>et al.</i> , 1960 |
| | 7 | 3 | 42.85 | - | 3 – 10 | Mihalca <i>et al.</i> , 2007 |
| | 19 | 2 | 10.52 | - | 4 – 5 | Shimalov <i>et al.</i> , 2000 |
| | 18 | 15 | 83 | 3.8 | 1 – 8 | In this study |

Table 3. Nematode species recorded in reptile species from Turkey

| Helminth Name | Host Species | Reference |
|--|--|--|
| <i>Entomelas entomelas</i> (Dujardin, 1845) | <i>Anguis fragilis</i> | Schad <i>et al.</i> , 1960, In this study |
| <i>Rhabdias bufonis</i> (Schränk, 1788) Stiles and Hassall, 1905 | <i>Anguis fragilis</i> | In this study |
| <i>Rhabdias fuscovenosa</i> (Railliet, 1899) Goodey, 1924 | <i>Natrix natrix</i> <i>Natrix tessellata</i> <i>Zamenis longissimus</i> | Yıldırımhan <i>et al.</i> , 2007b. Yıldırımhan <i>et al.</i> , 2007b. Düşen <i>et al.</i> , 2010 |
| <i>Strongyluris calotis</i> Baylis and Daubney, 1923 | <i>Laudakia stellio</i> | Yıldırımhan <i>et al.</i> , 2006c. |
| <i>Oswaldocruzia filiformis</i> (Goeze, 1782) Travassos, 1917 | <i>Anguis fragilis</i> | In this study |
| <i>Pharyngodon spinicauda</i> (Dujardin, 1845) | <i>Blanus strauchi</i> | In this study |
| <i>Parapharyngodon kasauli</i> (Chatterji, 1933) Markov and Bognadov, 1965 | <i>Laudakia stellio</i> | Yıldırımhan <i>et al.</i> , 2006c. |
| <i>Parapharyngodon tyche</i> Sulahian and Schacher, 1968 | <i>Laudakia caucasica</i> <i>Laudakia stellio</i> | Yıldırımhan <i>et al.</i> , 2006c. Yıldırımhan <i>et al.</i> , 2006c. |
| <i>Thelandros taylori</i> (Chatterji, 1935) Petter, 1966 | <i>Laudakia stellio</i> | Yıldırımhan <i>et al.</i> , 2006c. |
| <i>Thelandros baylisi</i> (Chatterji, 1935) | <i>Laudakia caucasica</i> | Yıldırımhan <i>et al.</i> , 2006c |
| <i>Cosmocerca ornata</i> (Dujardin, 1845) | <i>Anguis fragilis</i> | in this study |
| <i>Oxysomatium brevicaudatum</i> (Zeder, 1800) Railliet and Henry, 1916 | <i>Anguis fragilis</i> <i>Natrix natrix</i> <i>Zamenis longissimus</i> | Schad <i>et al.</i> , 1960, in this study Schad <i>et al.</i> , 1960. Düşen <i>et al.</i> , 2010 |
| <i>Eustrongylides excisus</i> Jagerskiöld, 1909 | <i>Natrix natrix</i> <i>Natrix tessellata</i> | Yıldırımhan <i>et al.</i> , 2007b. Yıldırımhan <i>et al.</i> , 2007b. |
| <i>Foleyella candezei</i> (Fraipont, 1882) Seurat, 1917 | <i>Laudakia caucasica</i> <i>Laudakia stellio</i> | Yıldırımhan <i>et al.</i> , 2006c. Yıldırımhan <i>et al.</i> , 2006c. |
| Third-stage ascaridoid larvae | <i>Laudakia stellio</i> | Yıldırımhan <i>et al.</i> , 2006c. |
| <i>Aplectana</i> sp. (larvae) | <i>Blanus strauchi</i> | in this study |
| <i>Kalicephalus</i> sp. | <i>Coronella austriaca</i> <i>Zamenis longissimus</i> | Düşen <i>et al.</i> , 2010 Düşen <i>et al.</i> , 2010 |
| <i>Ophidascaris</i> sp. | <i>Zamenis longissimus</i> | Düşen <i>et al.</i> , 2010 |
| unidentified nematode cyst | <i>Coronella austriaca</i> | Düşen <i>et al.</i> , 2010 |
| unidentified cyst | <i>Zamenis longissimus</i> | Düşen <i>et al.</i> , 2010 |

Shimalov *et al.* (2000) recorded *E. entomelas*, *Ox. brevicaudatum*, *O. filiformis* and *C. ornata* in *A. fragilis* from Southern part of Belarus. Sharpilo (2003) reported distribution of *Ox. causicum* in *A. fragilis* from *Caucasus region*. Borkovcová and Kopriva (2005) observed, *Ox. brevicaudatum*, *O. filiformis*, *R. fuscavenosus* and *Abbreviata* sp. in *A. fragilis*, from South Moravia (Czech Republic). Mihalca *et al.* (2007) reported *E. entomelas* in *A. fragilis* from Romania. We observed (*E. entomelas*, *R. bufonis*, *O. filiformis*, *Ox. brevicaudatum*) in this study. The infection data comparison of *A. fragilis* between in this study and other related studies data given in Table 2. *A. fragilis* represents a new host record for *C. ornata*, whereas the other nematode species (*O. filiformis*,

Ox. brevicaudatum and *R. bufonis*) found in this investigation are common parasites of European anurans and reptiles (Yamaguthi, 1961; Buchvarov, 1977; Anderson, 2000), and these species have been observed in several amphibians and reptiles species in Turkey. Nematodes previously recorded in reptiles in Turkey, are given in Table 3. Future detailed studies are needed in Reptiles from Turkey to add other metazoan endoparasites to Turkish reptile helminthofauna.

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