

Nematode parasites of the smooth snake, *Coronella austriaca* Laurenti, 1768 and the Aesculapian snake, *Zamenis longissimus* (Laurenti, 1768) (Ophidia: Colubridae), collected from North-Western Turkey

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Abstract. In this investigation, 11 Smooth snakes (*Coronella austriaca*), and 8 Aesculapian snakes (*Zamenis longissimus*) were collected between 1998 and 2007 from northwestern Turkey and were examined for the first time helminthologically. It was recorded that *Coronella austriaca* harbored 1 species of Nematoda (*Kalicephalus* sp.) and one unidentified nematode cyst; *Zamenis longissimus*, 4 species of Nematoda (*Rhabdias fuscovenosa*, *Oxysomatium brevicaudatum*, *Kalicephalus* sp. and *Ophidascaris* sp.) and two unidentified cysts. All helminths samples represented new host records for *Coronella austriaca* and *Zamenis longissimus* in Turkey. It was also recorded that Turkey is a new locality for *Kalicephalus* sp. and *Ophidascaris* sp.

Key Words: *Coronella austriaca*, *Zamenis longissimus*, Nematoda, Smooth snake, Aesculapian snake, Turkey

Introduction

In this study the nematode parasites of two snakes, Smooth Snake, *Coronella austriaca*, and Aesculapian Snake, *Zamenis longissimus* were examined. The Smooth snake (*C. austriaca*), usually inhabits stony, sandy and bushy areas in grasslands and edges of woods. It is a slow moving, calm and rarely biting species with a total length up to about 75 cm. Its known range includes Caucasus, Balkan Countries, Italy, Spain, Switzerland, Norway and Sweden. *C. austriaca* is widespread in North, East and Middle Anatolia in Turkey (Baran & Atatür, 1997, Budak & Göçmen 2008). Aesculapian snake, *Z. longissimus*, is usually encountered in sandy, dry, rocky terrain with shrubs and has a total length up to about 150 cm. *Z. longissimus* is widespread in middle and south Europe and

west Asia. In Turkey, its range includes the coastal zone of Black sea Region in Northern part of Anatolia (Baran & Atatür 1998, Budak & Göçmen 2008).

So far there is no helminthological report has been published on *C. austriaca* and *Z. longissimus* in Turkey. This is the first parasitological research which has been done in this mentioned geographic area.

Materials and Methods

C. austriaca were collected by hand between 1998 and 2007, from 5 localities in northwestern Turkey. Edremit, Balıkesir Province, at 200 m elevation (39° 48' N; 27° 12' E), Akyazı, Sakarya Province, at 200 m elevation (40° 41' N; 30° 38' E); Baraklı Lake, Bursa Province, at 1000 m elevation (36° 48' N; 29° 11' E); Tunalıköy-Kaynarca, Sakarya Province, at 400 m elevation (37° 44' N; 29° 06' E), Mustafakemalpaşa, Bursa province, at 450 m elevation

(36° 09' N; 35° 58' E). In total, 11 *C. austriaca* (6 males, 5 females) were examined for helminth parasites. The mean \pm SD snout-vent length (SVL) of specimens was 58.13 ± 11.8 cm, with a range from 29.5 to 70 cm.

Z. longissimus were collected by hand between 1998 and 2007 at 3 localities in Sakarya province, northwestern Turkey. Büyükyanık, Sakarya Province, at 200 m elevation (39°48'N; 27°12'E), Turnalıköy, Sakarya Province, at 1200 m elevation (40°06' N; 29°07'E), Akyazı, Sakarya Province, at 200 m elevation (40°41'N; 30°38'E). In total, 8 *Z. longissimus* (5 males 3 females) were examined for helminth parasites. The mean \pm SD snout-vent length (SVL) of specimens was 109.62 ± 21.63 cm, with a range from 80 to 42 cm.

Snakes were overdosed in ether-filled glass containers, fixed by injecting 7 % formalin into the body cavity and preserved in 70 % ethanol. The body cavity was opened by a longitudinal mid-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 and kidneys) were each mixed with 0.5 % saline solution and poured into Petri dishes for examination under a stereomicroscope. Nematodes were removed and identified from temporary mounts in undiluted 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 1-4/2009); host specimens were deposited in the Uludağ University, Department of Biology, Bursa Turkey.

Results and Discussion

Four nematode species were found infecting both *C. austriaca* and *Z. longissimus*. The site of infection in the snakes and the data on infection parameters for each host and species, are shown in Table 1. In summary, 20 individuals of 1 helminth species were collected from the 11 *C. austriaca* examined. Also, one unidentified nematode cyst was determined in the mesentery. Nematodes were observed in stomach, large-small intestines and rectum of this species. According the data obtained 3 (27.27%) snakes harbored the 1 species of parasite and the remaining 8 (72.72%) were uninfected. There were 10 ± 5.65 helminth individuals per infected host.

Eight *Z. longissimus* were examined, individuals of 4 helminth species and 2 unidentified nematode cysts were observed. Nematodes were recorded in stomach, lungs, large and small intestines and unidentified nematode cysts were observed on mesentery of this species. No individual host (*Z. longissimus*) harbored more than 2 helminth species. Of the infected snakes, 1 (12.5%) harbored 2 species of helminths, 2 (25%) harbored 2 species of helminths, 3 (37.5%) harbored 1 species of helminth; the remaining 2 (25%) snakes were uninfected. There were 1.33 ± 0.51 helminth species per infected host and 20.60 ± 21.40 helminth individuals per infected host.

So far as we were aware, *C. austriaca* and *Z. longissimus* have not been helminthologically investigated in Turkey. The two nematode species (*Kalicephalus* sp., *Ophidascaris* sp.) mentioned here are new location records for these snakes. *Rhabdias fuscovenosa* were recorded in *Natrix natrix*, and *N. tessellata* from Turkey (Yıldırımhan et al. 2007). Also, *R. fuscovenosa* were observed from several studies from Europe: Kirin (2002) in *N. natrix* from Bulgaria; Shimalov & Shimalov (2000) in *N. natrix* and *C. austriaca* from Belorussian Polesye; Mihalca et al. (2007) in *N. natrix* from Romania; Borkovcová & Kopřiva (2005) observed it in two lizards species *Anguis fragilis* (slow worm) and *Lacerta viridis* (green lizard) from Czech Republic. Also, Borkovcová & Kopřiva (2005) observed *Abbreviata* sp. in *C. austriaca*, although *Abbreviata* sp. was not recorded in *C. austriaca* in this study. Shimalov & Shimalov (2000) observed *Oxysomatium brevicaudatum* in *N. natrix*, *Vipera berus*. In this study *O. brevicaudatum* was observed in *Z. longissimus*, although it was not observed in *C. austriaca*.

Diaphanocephalid nematodes of *Kalicephalus* spp. are common parasites in the alimentary tract of snakes and lizards (Yamaguthi 1961). How snakes become infected with *Kalicephalus* under natural conditions is a mystery Anderson (2000). According to Anderson

Table 1. Nematode parasites of *C. austriaca* (N=11) and *Z. longissimus* (N=8) from Northwestern Turkey. (S: Stomach, SI: Small intestine; LI: Large intestine, R: Rectum, L: Lung, M: Mesentery).

Parasite (ZDEU Helm. Coll. no.)	Host	Site of Infection	No. of Infected (%)	Mean Intensity (\pm SD)	Individual Number (range)
<i>Rhabdias fuscovenosa</i> (ZDEU HELM 1/2009)	<i>Z. longissimus</i>	L	1 (12.5)	1	5
<i>Oxysomatium brevicaudatum</i> (ZDEU HELM 2/2009)	<i>Z. longissimus</i>	SI	1 (12.5)	1	1
<i>Kalicephalus</i> sp. (ZDEU HELM 3/2009)	<i>C. austriaca</i>	S, SI, LI, R	2 (18)	10 (\pm 5.65)	6-14
	<i>Z. longissimus</i>	S, SI, LI	5 (62.5)	18 (\pm 20.31)	2-44
<i>Ophidascaris</i> sp. (ZDEU HELM 4/2009)	<i>Z. longissimus</i>	S, SI, LI	1 (12.5)	1	8
Unidentified Cyst	<i>C. austriaca</i>	M	1 (9.09%)	1	1
Unidentified Cyst	<i>Z. longissimus</i>	M	2 (25)	1	1

(2000), Schad (1956) suggested larvae might attach to the latter and there is no evidence that skin penetration occurs. There is also the possibility that infective larvae could invade soft-bodied animals such as snails, slugs and amphibians cohabiting with snakes, if larvae persist in their tissues, these animals could serve as paratenic hosts.

C. austriaca is a lacertophagous snake that mainly feed on lizards and the young of other snakes, as well as small rodents and chicks especially young still in the nest. In addition, *Z. longissimus* feed on small mammals and birds (Luca et al. 1996, Baran & Atatür 1997). In this study, *Kalicephalus* sp. was recorded in both *C. austriaca* and *Z. longissimus* and were collected from close localities of Sakarya province (see localities). Same ecological factors in the distribution areas of both snakes could be effected the nematode transmission.

Ascaridoid nematodes of *Ophidascaris* spp. are commonly found parasitising snakes, lizard's oesophagus and stomach, and is rarely observed in amphibians worldwide (Yamaguthi 1961, Anderson 2000, Panuzitti et al. 2003). The parasites feed on ingesta in the gut of the definitive host and remain attached to

the gut wall at other times, sometimes clustered together with their heads buried in the centre of an elevated nodule, or looped through the stomach wall with the extremities extending into the lumen (Anderson 2000). Similarly we observed *Ophidascaris* sp. looped and clustered through the both stomach and intestine lumens of the snake samples.

Coronella austriaca represents a new host record for *Kalicephalus* sp. in Turkey. *Z. longissimus* represents a new host record for *Rhabdias fuscovenosa*, *O. brevicaudatum*, *Kalicephalus* sp., and *Ophidascaris* sp. in Turkey. Further studies are needed in reptiles from Turkey to add other metazoan endoparasites to the Turkish reptile helminthofauna.

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