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Research Note

A helminthological research on three Lacertid lizards species: *Acanthodactylus harranensis* Baran *et al*, 2005, *Acanthodactylus schreiberi* Boulenger, 1878, and *Mesalina brevirostris* Blanford, 1874, collected from South and South-eastern regions of Turkey

S. DÜŞEN[1]*, Y. KUMLUTAŞ[2], Ç. ILGAZ[2], A. AVCI[3], H. YAKA GÜL[1]

[1]Pamukkale University, Faculty of Arts and Sciences, Department of Biology, Kinikli Campus, Kinikli, 20017 Denizli, Turkey, E-mail**:** *sdusen@pau.edu.tr*, *serdar2290@yahoo.com*; [2]Dokuz Eylül University, Faculty of Science, Department of Biology, 35160, Buca/İzmir, Turkey; [3]Adnan Menderes University, Faculty of Science and Arts, Department of Biology, 09060 Aydın, Turkey

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Summary

A total of 45 lizards (*Acanthodactylus harranensis* [n = 15]*, Acanthodacthylus schreiberi* [n = 9] and *Mesalina brevirostris* [n = 21]) were collected from South and Southeastern Regions of Turkey and examined for helminth fauna. *Acanthodactylus harranensis* harbored 1 species of Nematoda (*Skrjabinodon* sp.), 1 species of Cestoda (*Oochoristica tuberculata*) and 1 species of Acanthocephala (*Centrorhynchus* sp. [cystacanth]). *Acanthodactylus schreiberi* harbored unidentified cysticercoids. *Mesalina brevirostris* harbored 1 species of Nematoda (*Spauligodon saxicolae*). All lizards represents new host records for the helminths reported in this study.
Keywords: *Acanthodactylus harranensis*; *Acanthodactylus schreiberi*; Lacertidae; *Mesalina brevirostris*; helminth; Turkey

Introduction

The Southeastern Anatolia Region of Turkey is a region which influenced by both Mediterranean and continental climatic factors (Rosen, 1998). The region has geographically arid character. According to our current literature knowledge, there is not any helminthological study for the lacertid lizards species in this arid region from Turkey. But, there are some limited helminthological studies of the other lizards species (Gekkonidae and Amphisbaenidae) distributed in close to this region: Mimioğlu *et al* (1963) were reported cysticercoids of *Joyeuxiella pasqualei* from *Hemidactylus turcicus* in Adana province, and they also examined the transmission of this helminth to cats. Similiarly, Tınar (1982, 1983) recorded a nematode species *Pharyngodon laevicauda*) and a cestode species (*Joyeuxiella pasqualei*) in *H. turcicus* from Adana province. Yıldırımhan *et al*. (2008) were reported one nematoda (*Spauligodon laevicauda*) and one acanthocephala species (*Macracanthorhynchus catulinus*) in *H. turcicus* from Hatay province and Yıldırımhan *et al*. (2009) were also observed two nematode taxa (*Macropharyngodon micipsae* and Thelastomatoid nematoda) in *Blanus strauchi* from Hatay province.

The genus *Acanthodactylus* Wiegmann, 1834 is inhabited dry and sparsely vegetated regions is a large genus of lacertid lizard widespread in the Iberian Peninsula, all of North Africa and in the Arabian Peninsula, the Middle East (northward to S Turkey, including Cyprus), S Iran, Pakistan, Afghanistan, and NW India (Anderson, 1999).

A. harranensis, Baran *et al*, 2005 is known from a single locality, including the ruins of the Ancient University in Harran, Şanlıurfa, Turkey and an area covered by hardened grey sand with intermixed blocks of sedimentary fossiliferous rocks. The vegetation is a step, with scattered shrubs mostly less than 50 cm high. It has a plumped body with a total length up to 25 cm (Baran *et al*., 2005; Baran *et al*., 2012).

A. schreiberi Boulenger, 1878 is a smaller lizard species than the *A. harranensis* with a total length of up to 23 cm and found in known Cyprus and Turkey (Tamar *et al*., 2014). The specimens of *A. schreiberi* were found within a grassy-bushy-sandy area in Turkey (Baran *et al*., 2012).

M. brevirostris Blanford, 1874 is distributed from the Sinai Desert (southern tip and Tiran Island), Northern Saudi Arabia, Jordan, Lebanon, Iraq, Kuwait, South Western Iran, the islands of the Arabian Gulf, Pakistan, the Iranian Plateau, Bahrain, Qatar to United Arab Emirates (Ilgaz *et al*., 2005). Its specimens can be found in the semi-desert plain amongst the numerous small stones. Also the various shrubs and annual grasses are commonly used as refuges. The total body length is up to 17 cm (Ilgaz *et al*., 2005).
So far, there have been no helminthological reports *on A. harranensis, A. schreiberi,* and *M. brevirostris* from Turkey. In this examination, helminths of these three lacertid species in Turkey are being reported for the first time.

Materials and Methods

The lizard samples were studied in this study, were obtained from Dokuz Eylül University, Faculty of Science, Department of Biology, Zoology Museum Collection in İzmir, Turkey. Lizards were collected by hand between 2002 and 2009, in spring and summer seasons (April to June), from four different localities in South and South-eastern part of Turkey. *A. schreiberi* (1) (Botaş, Adana, 39 m asl, 36°53'1.01" N; 35°55'59.06" E), *A. harranensis* (3) (Harran, Şanlıurfa, 364 m. asl, 36°52'1.66" N; 39°1'26.93" E), and *M. brevirostris* (2), (4) (Ceylanpınar, Şanlıurfa, 354 m asl, 36°49'36.43" N; 40°0'34.88" E; Akçakale, Şanlıurfa, 350 m. asl, 36°43'19.03" N; 38°58'52.02" E) (Fig. 1).
In total, 15 adult *A. harranensis* (5 males, 10 females), 9 adult *A. schreiberi* (7 males, 2 females), and 21 adult *M. brevirostris* (15 males, 6 females) samples were examined for helminth parasites.
The mean±SD snout-vent length (SVL) of specimens were *A. harranensis* 83.44±4.80 mm, with a range from 74.90 to 90.48 mm; *A. schreiberi* 58.78±11.03 mm, with a range from 46.94 to 77 mm, and *M. brevirostris* 54.97±2.49 mm, with a range from 49.30 to 58.94 mm, respectively.
The body cavities of the lizards were opened by a standard longitidutinal ventral incision. The alimentary canals were excised and separated into stomach, lungs, liver, small-large intestine and rectum. The contents of each part and other organs were poured into glass petri dishes for examination under a stereomicroscope with saline solution. Cestode samples were stained with acetocarmine, dehydrated, cleared in cedar oil; nematodes were also cleared in glycerol. Helminth samples were mounted in Canada Balsame or Entellan®. Acanthocephalan and cestode cyst samples were opened and larvae seperated with thin dissection needles and thin brushes under a stereomicroscope. Intensities are presented as mean values followed by the range. Voucher host specimens were deposited in Dokuz Eylül University, Faculty of Science Department of Biology, Zoology Museum, and parasite specimens were deposited in Pamukkale University, Faculty of Sciences and Arts, Department of Biology, Denizli, Turkey (PAU-HELM-1-5/2014).
The data collected from adult hosts (*A. harranensis*) were analysed using Chi-square test with Minitab Version 14 (between two adult sexes and each observed helmint taxa individual numbers), *M. brevirostris* and *A. schreiberi* were not analysed due to insufficient observed helminth individual numbers in these lizard species. Also, simple linear regression analyses (Minitab Version 14) were performed (between host SVL and each observed helmint taxa individual numbers) for all studied lizards taxa.

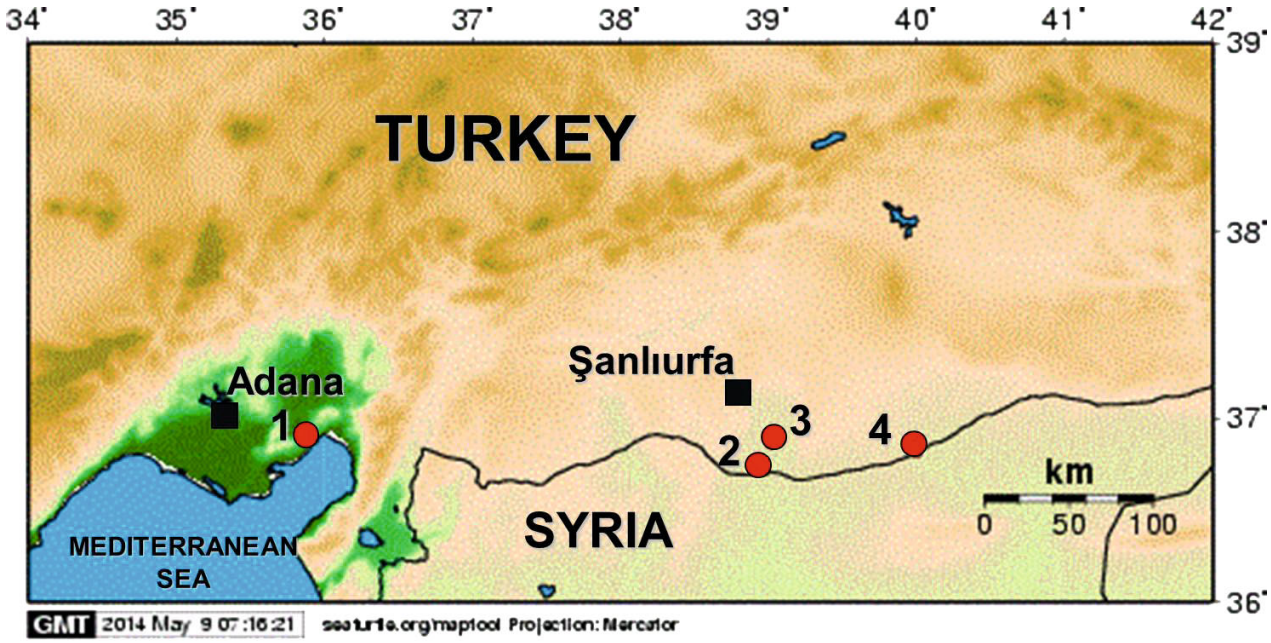

Fig. 1. The collection localities of *A. schreiberi*, *A. harranensis* and *M. brevirostris* from the South and Southeastern Region of Turkey
(For localities numbers please see the Material and methods section)

Results and Discussion

A. harranensis harbored 1 species of nematode (*Skrjabinodon* sp.), 1 species of cestode (*Oochoristica tuberculata*), and 1 species of acantocephalan (*Centrorhynchus* sp., in cystacanth stage); *A. schreiberi* harbored only 1 unidentified cestode species (in cysticercoid stage) and *M. brevirostris* harbored 1 species of nematode (*Spauligodon saxicolae*).

Fifteen *A. harranensis* examined, 304 individuals of 3 helminth species were determined. Helminths were recorded the embedded in liver, mesenteries, the outer surface of stomach wall, small and large intestines of this species. No individual host was harbored more than 3 helminth species. Of the infected lizards, 5 (33.33 %) were harbored 2 species of helminth, 7 (46.66 %) were harbored 1 species of helminth, the remaining 3 (20 %) were uninfected. A total of 25.10±14.88 helminth individuals were found per infected host.

Five individuals of 1 unidentified cysticercoid stage cestode species were found 9 *A. schreiberi* samples. Helminths were recorded embedded in the small intestine mucosa of this species, 1 (11.11 %) individuals of *A. schreiberi* was harbored only 1 helminth; the remaining 8 (88.89 %) were uninfected. There is 1 helminth individual per infected host.

Twenty-one *M. brevirostris* examined, 138 individuals of 1 helminth species were observed. Helminths were recorded in the large intestine and rectum of this species, 14 (66.67 %) individuals of *M. brevirostris* was harbored only 1 helminth; the remaining 7 (33.33 %) lizard samples were uninfected. There were 9.85±8.28 helminth individuals were found per infected host. No helminths were observed in body cavities and the other organs of these three lizard species. Data on helminth infections of *A. harranensis*, *A. schreiberi*, and *M. brevirostris* are presented in Table 1.

There is a significant difference between adult sexes of *A. harranensis* and observed helmint taxa individual numbers (X^2=34.113; d.f.=2; *P<0.05*). *Skrjabinodon* sp. and O. *tuberculata* individuals were observed in female lizards, *Centrorhynchus* sp. individuals is observed in male lizards. *M. brevirostris* and *A. schreiberi* were not analysed due to insufficient observed helminth individual numbers in these lizard species. According to results of the simple linear regression analyses: There is no significant correlation existing between SVL of *A. harranensis* and each observed individual numbers with *Skrjabinodon* sp. (f=0.03; d.f.= 13; R^2 = 0.2; *P>0.05*), *O. tuberculata* (f=1.78; d.f.= 13; R^2=12.1; *P>0.05*) and *Centrorhynchus* sp. (f=0.41; d.f.= 13; R^2 = 3.1; *P>0.05*); there is no significant correlation was detected between SVL of *A. schreiberi* and each observed individual numbers with Unidentified cestode species (in cysticercoid stage) (f=0.00; d.f.= 7; R^2 = 0; *P>0.05*). Similiarly, there is no significant correlation reported between SVL of *M. brevirostris* and each observed individual numbers with *S. saxicolae* (f=0.94; d.f.= 19; R^2=5; *P>0.05*).

The genus, *Spauligodon* includes a cosmopolitan group of nematode parasites of reptiles according to Bursey and Goldberg (2011a) comprising at least 47 described species, with 20 of them occurring in the Palearctic region (Jorge *et al*., 2012). Ikromov and Cho (2004) reported *S. saxicolae* from *Eremias velox*; Uhlířová (2005) recorded *S. saxicolae* from *Darevskia caucasica*; Murvanidze *et al*. (2008) reported *Spauligodon saxicolae* in *Lacerta strigata*, *Darevskia saxicola* (formerly known as *Lacerta saxicola*), *D. rudis* (formerly known as *Lacerta rudis*) and *Dolichopis jugularis*

Table 1. Helminths of *A. harranensis, A. schreiberi* and *M. brevirostris* from Turkey

HELMINTH, (Helm. Coll. No.)	Host	Developmental stage	Site of infection	No. of infected host (%)	Mean intensity	Range
NEMATODA, Pharyngodonidae *Spauligodon saxicolae* Sharpilo, 1961 (PAU-HELM-1/2014)	*M. brevirostris*	Adult	LI, R	66.67	9.85	2 – 35
NEMATODA, Pharyngodonidae *Skrjabinodon* sp. (PAU-HELM-2/2014)	*A. harranensis*	Adult	LI	66.67	25.10	5 – 62
CESTODA Unidentified cestode species (in cysticercoid stage) (PAU-HELM-3/2014)	*A. schreiberi*	Larval	SI	11.11	5	5
CESTODA, Anoplocephalidae *Oochoristica tuberculata* (Rudolphi, 1819) Lühe, 1898 (PAU-HELM-4/2014)	*A. harranensis*	Adult	SI	13.33	6	1 – 11
ACANTHOCEPHALA, Centrorhynchidae *Centrorhynchus* sp. (PAU-HELM-5/2014) (in cystacanth stage)	*A. harranensis*	Larval	ESS, M, L	33.33	8.20	2 – 24

ESS: External Surface of Stomach**, L:** Liver, **LI:** Large intestine, **M:** Mesenteries, **R:** Rectum, **SI:** Small intestine

(formerly known as *Coluber jugularis*); Carretero *et al*. (2011) observed *S. saxicolae* from *Podarcis vaucheri* complex. In Turkey, Yıldırımhan (1999) reported *S. saxicolae* from *Anatololacerta danfordi* (formerly known as *Lacerta danfordi*), *D. saxicola*, *Podarcis siculus* and *P. muralis* (Northwestern part of Turkey); *S. saxicolae* was observed in *Eremias strauchi* and *E. suphani* collected from Eastern Part of Turkey (Dusen *et al*., 2013). Also, Roca *et al.* (2015) reported *S. saxicolae* in the samples of *Darevskia rudis* from northern part of Turkey. In this study, *S. saxicolae* was observed for first time from *A. harranensis*.

The genus *Skrjabinodon* Inglis, 1968 has a widely distributed group of nematode parasites of reptile families. Inglis (1968) revised *Parathelandros* Diesing, 1861, retaining the genus for parasites of Australian amphibians and erecting *Skrjabinodon* as a new genus for parasites of reptiles (Bursey & Goldberg, 1999). There are several reptile family members infected by different *Skrjabinodon* species were recorded by various researchers: Gekkonidae (Moravec & Baruš, 1990; Bursey & Goldberg, 1999; Hering-Hagenbeck *et al*., 2002; Matsuo & Oku, 2002; Jones, 2013; Bursey & Brooks, 2010), Agamidae (Rezazadeh *et al*., 2012), Corytophanidae (Bursey & Brooks, 2010), Iguanidae (Bundy *et al*., 1987; Bursey & Brooks, 2010; Bursey & Goldberg, 2007), Phrynosomatidae (Bursey & Brooks, 2010), Polychrotidae (Bursey & Brooks, 2010), Gymnophthalmidae (Bursey & Goldberg, 2011b), Lacertidae (Roca & Ferragut, 1989; Hornero & Roca, 1992; Vicente *et al*., 2000; Yıldırımhan *et al*., 2011), Anguidae (Bursey & Goldberg, 2006), Teiidae (Bursey & Brooks, 2010), and Scincidae (Vicente *et al*., 2000; Hering-Hagenbeck *et al*., 2002; Vicente *et al*., 2002; Rocha *et al*., 2003; Bursey *et al*., 2008; Incedogan *et al*., 2014). In this study, we observed for the first time *Skrjabinodon* sp. from *A. harranensis*.

The genus *Oochoristica* contains medium sized of tapeworm species parasitic as adults in reptiles and mammals (Hughes *et al*., 1941; Yamaguthi, 1959). Hughes *et al.* (1941) published detailed report for *O. tuberculata* from different reptile species (*Acanthodactylus pardalis*, *Agama agama*, *A. sanguinolenta*, *Chalcides ocellatus*, *Eumeces schneiderii*, *L. agilis*, *L. lepida*, *Podarcis muralis* (formerly known as *Lacerta muralis*), *L. ocellata*, *L. viridis*, *Pseudopus apodus* (formerly known as *Ophisaurus apodus*), *Uromastix acanthinurus*, *Varanus griseus*, *Cerastes vipera*, *Eryx jaculus*, and *Psammophis sibilans*); also Yamaguthi, (1959) reported this cestode from *Mabuya*, *Coelopeltis* (synonim of *Malpolon*); Sharpilo *et al.* (2001) recorded *O. tuberculata* from *L. agilis*; Ibrahim *et al*. (2005) reported *O. tuberculata* from *Chalcides ocellatus*; Bakiyev and Kirillov (2007) observed *O. tuberculata* from *V. berus*; Murvanidze *et al*. (2008) recorded *O. tuberculata* from *A. caucasica*, and *L. strigata*; Dugarov *et al*. (2012) recorded *O. tuberculata* from *E. argus.* In Turkey, Yıldırımhan (1999) reported *O. tuberculata* from *L. viridis* in Bursa Province; Yıldırımhan *et al*. (2006) observed *O. tuberculata* from *Laudakia caucasica* in Dogubayazıt (Ağrı Province); Yıldırımhan *et al*. (2011) observed *O. tuberculata* from *L. trilineata* in Bursa Province. Also, Dusen *et al*. (2013) reported *O. tuberculata* from *E. suphani* collected from Eastern Part of Turkey. Incedoğan *et al*. (2014) observed *O. tuberculata* from *Chalcides ocellatus* from middle and western parts of Mediterranean region of Turkey. In this study, we observed for the first time *O. tuberculata* from *A. harranensis*.

The adults of the acanthocephalan genus *Centrorhynchus* Lühe, 1911 (Polymorphida: Centrorhynchidae) are parasites mainly of birds of the orders Falconiformes and Strigiformes, but a few species are known from mammals and reptiles. With almost 90 species, this is the largest acanthocephalan genus occurring in birds of prey (Golvan, 1994; Richardson and Nickol, 1995). There are numerous amphibian, reptile, bird, and mammalian hosts records for *Centrorhynchus* species were presented by different researchers. Nickol (1969) observed cystacanths of *C. conspectus* from mesenteries in *Desmognathus fuscus* and *Plethodon glutinosus*; Marchand and Grita-Timoulali (1992) recorded a paratenic host *Bufo regularis;* Yıldırımhan *et al*. (2005) observed cystacanths of *Centrorhynchus* sp. in *Pelophylax ridibundus* (formerly known as *Rana ridibunda*); Dos Santos *et al*. (2010) observed cystacanths of *Centrorhynchus* sp. in *Rhinella fernandezae* (in amphibian hosts). Ward (1940) reported cystacanths of *Centrorhynchus* sp. in intestinal wall of *Natrix sipedon*; Schmidt and Kuntz, (1969) reported the paratenic reptile hosts of *C. spilornae* in *Dinodon rufozonatum*, *Psammodynastes pulverulentis Agkistrodon acutus* and *Trimeresurus stejnegeri* (in reptile hosts).

Vancleave (1918) recorded *C. pinguis* intestine of *Pica pica*; Ward (1956) observed *C. milvus* in *Milvus migrans*; Schmidt and Neiland (1966) reported *C. kuntzi* in *Buteo magnirostris*, *C. nicaraguensis* in *Dromococcyx phasianellus*, *C. crotophagicola* in *Piaya cayana* and *Crotophaga sulcirostris*, *C. albidus* in *Ictinia plumbea*, and 1 unidentified *Centrorhynchus* species from *Tyto alba*; Schmidt and Kuntz (1969) observed *C. spilornae* and *C. amphibius* in *Spilornis cheela*, *Accipiter soloensis*, *A. virgatus affinis*, and *Hirundo rustica*; Thatcher and Nickol, (1972) observed *C. giganteum* and *C. tumidulus* in *Buteogallus urubitinga, Leucopternis semiplumbea Heterospizias meridionalis* and also, unidentified *Centrorhynchus* sp. in *Leucopternis princeps.* Nickol (1983) reported *C. kuntzi* and *C. spinosus* in *Bubo virginianus*, *Buteo jamaicensis*, *B. lineatus*, *B. platypterus*, *Melanerpes carolinus*, and *Strix varia*: Ewald and Crompton (1993) reported *C. aluconis* in *Strix aluco*; Tezel *et al*. (2014) recorded *C. amphibius* in *B. buteo* (in bird hosts).

Cable and Quick (1954) reported cystacanths of *Centrorhynchus* sp. from *Herpestes javanicus auropunctatus*; Richardson (1993) cystacanths of *C. wardae* in *Didelphis virginiana*; Yabsley and Noblet, (1999) observed the cystacanths of *C. conspectus* in *Procyon lotor*; Kirillova and Kirillov (2007) reported cystacanths of *C. aluconis* in *Sorex araneus* (in mammalian hosts). In this study, we observed for the first time *Centrorhynchus* sp. from *A. harranensis*, in view of the results obtained, it can be concluded that *Centrorhynchus* sp. parasitised *A. harranensis* as a paratenic host in Turkey.

In summary: *A. harranensis* represents new host records for *O. tuberculata*, *Skrjabinodon* sp., and *Centrorhynchus* sp. (in

cystacanth stage), *A. schreiberi* represents new host record for unidentified cestode species (in cysticercoid stage), and also, *M. brevirostris* represents new host records for *S. saxicolae*; from Turkey. In this investigation, we expanded the zoogeographical and host-range distribution of various helminth species of Turkish reptile helminth fauna.

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