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Studies on gastrointestinal helminth of three Lacertid Lizard species, *Podarcis muralis*, *Podarcis siculus* and *Ophisops elegans* (Sauria: Lacertidae) from Bursa, North-Western Turkey

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**Summary**

A total of 80 specimens of three species of lacertid *Podarcis muralis* (39), *Podarcis siculus* (18) and *Ophisops elegans* (23) from Bursa were examined for helminths. One species of Digenea, *Plagiorchis elegans*, 1 species of Cestoda, *Mesocestoides* sp. (tetrahyridium); and 3 species of Nematoda, *Skrjabinodon medinae*, *Spauligodon saxicola* and *Skrjabinelazia hoffmanni* were found. The helminths reported in this study are generalist helminths that infect a number of lizards.

**Keywords:** *Podarcis muralis; Podarcis siculus; Ophisops elegans; Digenea; Cestoda; Nematoda*

**Introduction**

Common Wall Lizard, *Podarcis muralis* (Laurenti, 1768) inhabits dry, sunny, rocky places, sometimes sparsely wooded areas; seen on garden walls and ruins. This species known from Middle and South Europe and Turkey; with a vertical distribution up to 2000 m. Istanbul Wall Lizard, *Podarcis siculus* (Rafinesque-Schmaltz, 1810) prefers rocky-stony places and rough stone walls, seen on garden walls or in cemeteries. Its range includes South Europe and North-west Turkey, also an isolated colony in Philadelphia (USA); with a vertical distribution up to 1800 m. A single subspecies *P. s. hieroglyphica* Berthold, 1842 lives in Turkey, in urban Istanbul and Bursa and some islands in the Sea of Marmara (Ugurtas et al. 2000). Snake – eyed Lizard, *Ophisops elegans* Menetries, 1832 is a ground-dwelling species usually inhabiting open and plains with sparse vegetation and rocky, soily substrates; prefers steppes. Its range extends from southern Balkan countries, Aegean and Mediterranean to SW Asia and Punjab in N. India; with a vertical distribution to 2000 m. (Baran & Atatur 1998).

To our knowledge, there are just two report of helminths in *Podarcis muralis*; Garcia-Adell and Roca (1988) reported 8 species of helminths from Spain including *Plagiorchis molini*, *Oochoristica* sp., *Mesocestoides* sp., *Skrjabinodon medinae*, *Spauligodon carbonelli*, *Skrjabinelazia pyrenaica*, *Skrjabinelazia* sp. and *Oswaldocruzia filiformis*. Kirin (2002a) reported 3 species of helminths from Bulgaria *Mesocestoides* spp., *Spauligodon extenuatus* and *Skrjabinelazia hoffmanni*.

There is just one report of helminth in *Podarcis siculus*. This study was conducted in Spain. Roca (1995) reported 6 species of helminths, *Paradistomum mutable*, *Oochoristica gallica*, *Skrjabinodon medinae*, *Spauligodon carbonelli*, *Skrjabinelazia pyrenaica*, *Skrjabinelazia* sp. and *Oswaldocruzia filiformis*. Kirin (2002a) reported 3 species of helminths from Bulgaria *Mesocestoides* spp., *Spauligodon extenuatus* and *Skrjabinelazia hoffmanni*.

In two reports related to *Ophisops elegans*, Goldberg and Bursey (2010) examined Iranian species and came across *Oochoristica tuberculata* and Nelli et al. (2014) encountered *Mesocestoides lineatus* in Armenian species. Nothing has been published on helminths of *P. muralis*, *P. siculus* and *O. elegans* from Bursa province, North-western Turkey. This study provides new helminth data for these lizard species from Bursa Province in Turkey.

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Materials and Methods

A total of 80 lacertid lizards representing three species (Podarcis muralis, Podarcis siculus and Ophisops elegans) were examined for helminths. Thirty nine specimens of P. muralis (21 males, 18 females) were collected by hand in May 1997 – August 1998 from two different locations of Bursa Province, in Turkey. Number of lizards were n=17 at Sogukpınar, n=22 at Baraklı village. Sixteen specimens of P. siculus (6 males, 10 females) were collected by hand in May 1997 – July 1998 from two different locations of Bursa Province, in Turkey. Number of lizards were n=5 at İznik, n=11 at Fethiye village. Twenty one specimens of O. elegans (15 males, 4 females and 2 juveniles) were collected by hand in December 1996 – October 1998 from two different locations of Bursa Province, in Turkey. Number of lizards were n=6 at Karacabey, n=15 at Baraklı village. Lizards were humanely killed with sodium pentobarbital. The body cavity was opened and the digestive tract was removed. The esophagus, stomach, small and large intestines and lungs were opened and separately examined for helminths under a dissecting microscope. Helminths from each host were placed in individuals of ethanol for storage. For study, helminths were cleared in a drop of undiluted glycerol on a glass slide. Nematodes were identified from these temporary preparations. Digenea and Cestodes were fixed in 70 % ethanol, stained with iron-carmine, dehydrated, cleared and mounted in Entellan (Georgiev et al., 1986). Helminth identifications were based on the reference keys of Yamaguti (1961) and Schmidt (1986). Helminth voucher specimens were deposited in the helminth collection of Uludag University Museum of Zoology, Bursa, Turkey. Lizard specimens were deposited in the Department of Biology, Uludag University, Bursa, Turkey.

Ethical Approval and/or Informed Consent

All applicable national and institutional guidelines for the care and use of animals were followed.

Results

Podarcis muralis (Laurenti, 1768) Common Wall Lizard

There were 5 species of helminths in these lizards. Plagiorchis elegans (Rudolphi, 1802)

(Braun, 1902)

(Syn. Fasciola elegans Rudolphi, 1802; Fasciola cirrata Rudolphi, 1802; Distoma colubri natrix Rudolphi, 1809; Distoma elegans (Rudolphi, 1802) Rudolphi,1809; Distoma colubri tessellati Rudolphi, 1819; Distoma lacertae Rudolphi, 1819; Distomum (Brachylaimus) elegans (Rudolphi, 1802) Dujardin 1845; Distomum erraticum Linstow 1894; Plagiorchis cirratus (Rudolph, 1802) Lühe, 1899; Plagiorchis mentulatus (Rudolphi 1819) Stossich, 1904; Plagiorchis asperus Stossich, 1904; Plagiorchis notabilis Nicoll, 1909; Plagiorchis mari Skrjabin, 1920; Plagiorchis blumbergi Massino 1927; Plagiorchis brauni Massino 1927; Plagiorchis loossi Massino 1927; Plagiorchis massinoi Petrov and Tichonoff , 1927; Plagiorchis multiglandularis Semenow, 1927; Plagiorchis skrabajini Massino 1927; Plagiorchis ulhmovi Massino, 1927; Plagiorchis potanini Skrjabin, 1928; Plagiorchis eutamatis Schulz, 1932; Plagiorchis casarci Mehra, 1937; Plagiorchis ferrugineum Mehra, 1937; Plagiorchis eutamaitis Zibethicus Vassilev 1939; Plagiorchis extremus Strom, 1940; Plagiorchis strictus Strom, 1940; Plagiorchis fujii Ogata, 1941; Plagiorchis psczelkini Sobolev, 1946; Plagiorchis petrovi Fedishin, 1949; Plagiorchis oscineus Sudarikov, 1950; Plagiorchis castoris Orloff et Moskalev, 1953; Plagiorchis blatenensis Chalupska, 1954; Plagiorchis raabei Furmaga, 1956; Plagiorchis stefanski Furmaga, 1956, Plagiorchis musirs sensu Prokopic and Genov, 1974; Plagiorchis proximus sensu Prokopic and Genov, 1974; Plagiorchis cuculi Schaldynbin, Anikin, Budkin et Suslova, 1977)

Prevalence and mean intensity: 11/39 (28 %), 3 ± 2.38, 1 – 8.

Temporal distribution: 19 July 1998, 7 host with 2, 8, 1, 6, 4, 1, 1 respectively; 20 July 1998, 4 host with 2, 1, 3, 5 respectively.

Site of infection: Small intestine.

Type host and type locality: House sparrow, Passer domesticus, Germany (Rudolphi, 1802). Additional Turkish records: None.

Other reported hosts: Amphibia: yellowbelly toad, Bombina variegata, (Prokopic & Krivanec, 1975); pool frog, Pelophylax lessoniae, (reported as Rana esculenta, Prokopic & Krivanec, 1975); common frog, Rana temporaria, (Capuse, 1971); Reptilia: sand lizard, Lacerta agilis, (Shevechenko & Barabashova, 1958; Moravec, 1963; Capuse, 1971; Lewin, 1992a; Shimalov et al., 2000; Sharpilo et al., 2001; Borkovcova & Kopriva, 2004); European green lizard, Lacerta viridis, (Capuse, 1971); viviparous lizard, Zootoca vivipara, (reported as Lacerta vivipara, Lewin, 1992b; Shimalov et al., 2000); European grass snake, Natrix natrix (Capuse, 1971); Aves: northern goshawk, Accipiter gentilis, (Silko, 1998); Eurasian sparrowhawk, Accipiter nisus, (Silko, 1998); spotted sandpiper, Actitis macularius, (Didyk et al., 2007); Balkan teal, Anas formosa, (Bykhovskaya-Pavlovskaya, 1962); mallard, Anas platyrhynchos, (Styczynska-Jurewicz, 1962); little stint, Calidris minuta, (Bykhovskaya-Pavlovskaya, 1962); twite, Carduelis flavirostris, (Massino, 1929); ruddy shelduck, Casarca ferruginea, (Mehra, 1937); black tern, Chlidonias nigra, (Massino, 1929); western marsh harrier, Circus aeruginosus, (Bykhovskaya-Pavlovskaya, 1953; Krasnolobova, 1987); northern harrier, Circus cyaneus, (Krasnolobova, 1987); pallid harrier, Circus macrourus, (Bykhovskaya-Pavlovskaya, 1953; Krasnolobova, 1987); common quail, Coturnix coturnix, (Bykhovskaya-Pavlovskaya, 1953); common raven, Corvus corax, (Massino, 1927); carrion crow, Corvus corone, (Mühl, 1896); rook, Corvus frugilegus, (Braun, 1902); Eurasian jackdaw, Corvus monedula, (Massino, 1927); corncrake, Crex crex, (Macko, 1969); common cuckoo, Cuculus canorus, (Dubinia & Kulakova, 1960); common house-martin, Delichon urbica, (Odening, 1961); great spotted woodpecker, Dendrocopos major, (Styczynska-Jurewicz, 1962); merlin, Falco columbarius, (Massino, 1927; Krasnolobova, 1987); peregrine falcon, Falco
Tichonoff, 1927; Desrochers & Curtis, 1987); bank vole, *Microtus arvalis*, (Chalupsky, 1954); house mouse, *Mus musculus*, (Odening, 1959); water shrew, *Neomys fodiens*, (Panov & Karpenko, 2004); muskrat, *Ondatra zibethicus*, (Sey, 1965; Matskasi, 1971); common shrew, *Sorex araneus*, (Matskasi, 1971).

**Geographic range:** Northern hemisphere.

**Remarks:** All species of *Plagiorchis* use aquatic snails as first intermediate hosts and insects as second intermediate hosts (Roberts & Janovy, 2000). Given the broad host range any insectivore might be expected to harbor *Plagiorchis elegans*. *P. muralis* represents the second host record for *P. elegans*.

**Mesocestoides sp. (tetrahyridium);**

**Prevalence and range:** 1 of 39 (3%), 32.

**Temporal distribution:** 2 June 1997, 1 host with 32.

**Site of infection:** Body cavity.

**Additional Turkish records:** Apathy capsadoica (Birlik et al., 2015); Anatololacerta danfordi (Gürelli et al. 2007); Darevskaia rudis (Birlik et al., 2018a); Darevskaia valentini (Birlik et al., 2018b); Lacerta trilineata (Yıldırımhan et al., 2011); Phoeniculacerta laevis (Birlik et al. 2016).

**Other reported reptilian hosts:** The genus *Mesocestoides* is cosmopolitan and tetrahyridia can be found in all classes of vertebrates. We have listed known accidental or paratenic hosts reported from the Palearctic biogeographic region: Slow worm, *Anguis fragilis* (Levin, 1990); Mongolian racerunner, *Eremias argus* (Dugarov et al., 2018); Sand lizard, *Lacerta agilis* (Nelli et al., 2014; Levin, 1992a; Sharpilo et al., 2001); Redbelly rock agama, *Paralaudakia erythrogaster* (reported as *Agama erythrogaster*, Radchenko, 1973); Eastern giant emerald lizard, *Lacerta media* (Nelli et al., 2014); Iberian emerald lizard, *Lacerta schreiberi* (Roca et al., 1989); Mediterannean sand lizard, *Lacerta agilis* (reported as *Podarcis agilis*, Santoro et al., 2013); Aesculapean snake, *Elaphe longissima*, (reported as *Ancystrodon halys*, Biserkov, 1996); Western whip snake, *Hierophis viridiflavus* (Santoro et al., 2013); Aesculapean snake, *Zamenis longissimus* (reported as *Elaphe longissima*, Biserkov, 1996); Holy's pipe viper, *Gloydius halys* (reported as *Ancestrodon halys*, Bogdanov et al., 1969); European grass snake, *Natrix natrix* (Lewin, 1992b); nose-horned viper, *Vipera ammodytes* (Biserkov, 1995).

**Geographic range:** Cosmopolitan (McAllister et al., 1991).
intermediate host, and a purported arthropod first intermediate host (Rausch, 1994). Tetrathyrida are frequently found in the body cavities of amphibians, reptiles, birds and mammals (Padgett & Boyce, 2004). *P. muralis* represents the eighth host record for the genus *Mesocestoides* in Turkey.

**Skrjabinelazia hoffmanni** Li, 1934  
**Prevalence, mean intensity and range:** 4 of 39 (10 %) 3 ± 3.5, 1 – 8  
**Temporal distribution:** 2 June 1997, 2 host with 8, 1 respectively; 19 July 1998, 1 host with 1; 20 July 1998, 1 host with 1.  
**Site of infection:** Small intestine.  
**Type host and type locality:** Mongolian racerunner, *Eremias argus*, China (Li, 1934).

**Additional Turkish records:**  
*Darevskia rudis* (Roca et al., 2015a; Birlik et al., 2018a); *Darevskia valentini* (Birlik et al., 2018b); *Lacerta trilineata* (Yıldırımhan et al., 2011), *Phoenicolacerta laevis* (Birlik et al., 2016).  
**Other reports:** *Lacerta schreiberi* (Roca & Ferragut, 1989); *Podarcis bocagei* (Roca et al., 1989); *Podarcis hispanica* (Roca et al., 1988b; Roc & Lluch, 1988; Roca et al., 1989; Hornero & Roca, 1992a); Liford’s wall lizard, *Podarcis lilfordi* (Hornero & Roca, 1992b; Roca & Hornero, 1994); *Podarcis muralis* (Dollfus et al., 1961; García-Calvente, 1948, 1992a); Lilford’s wall lizard, *Darevskia rudis* (Dolar, 2016); *Podarcis pityusensis* (Roca & Hornero, 1991; Hornero & Roca, 1992a; Roca & Hornero, 1994); *Zootoca vivipara* (Host reported as *Lacerta vivipara*, Dollfus et al., 1961).  
**Geographic range:** France (Dollfus et al., 1961); Spain (Roca & Hornero, 1994); Turkey (Yıldırımhan et al., 2011).  
**Remarks:** *P. muralis* represents the seventh host record for the species *Skrjabinelazia medinai* in Turkey.

**Spauligodon saxicolae** Sharplio, 1961  
**Prevalence, mean intensity and range:** 2 of 39 (5 %) 18 ± 24, 1 – 35  
**Temporal distribution:** 19 July 1998, 2 host with 1, 35 respectively.  
**Site of infection:** Large intestine.  
**Type host and type locality:** Scaly lizard, *Lacerta saxicola* (Sharplio, 1962) Ukraine.  
**Additional Turkish records:** *Darevskia bendimahiensis* (Roca et al., 2015a); *Darevskia clarkorum* (Roca et al., 2016); *Darevskia parvula* (Roca et al., 2016); *Darevskia radde* (Roca et al., 2016); *Darevskia rudis* (Roca et al., 2016; Murvanidze et al., 2008); *Darevskia sapphirina* (Roca et al., 2015b); *Darevskia unisexualis* (Roca et al., 2016); *Darevskia uzzelli* (Roca et al., 2015b); *Darevskia valentini* (Roca et al., 2016); *Eremias strauchi* (Düşen et al., 2013); *Eremias suphani* (Düşen et al., 2013); *Mesalina breviostris* (Düşen et al., 2016).  
**Other reports:** *Eremias velox* (Ikromov & Cho, 2004); *Darevskia caucasica* (Uhlírová, 2005); *Lacerta strigata* (Murvanidze et al., 2008); *Darevskia saxicola* (Goldin, 1975; Murvanidze et al., 2008); *Darevskia rudis* (Murvanidze et al., 2008); *Podarcis vaucheri* (Carretero et al., 2011); *Coluber jugularis* (Murvanidze et al., 2008).  
**Geographic range:** Algeria (Carretero et al., 2011); Azerbaijan (Uhlírová, 2005); Crimea (Goldin, 1975); Georgia (Murvanidze et al., 2008); Turkey (Dusen et al. 2013).  
**Remarks:** *P. muralis* represents the 12th reptilian host record for *Spauligodon saxicolae* in Turkey.
**Podarcis siculus** (Rafinesque-Schmaltz, 1810) Istanbul Wall Lizard

One helminth species was found in the host.

**Spauligodon saxicolae** Sharplio, 1961

**Prevalence, mean intensity and range:** 12 of 16 (75 %), 33 ± 29.5, 4 – 115.

**Temporal distribution:** 5 May 1997, 2 host with 20, 30 respectively; 25 May 1998, 7 host with 30, 25, 32, 40, 6, 7, 43, 15 respectively; 24 June 1998, 2 host with 4, 60 respectively.

**Site of infection:** Large intestine.

**Remarks:** See remarks above under *Podarcis muralis*.

**Ophisops elegans** Menetries, 1832 Snake – eyed Lizard

No helminths were found in the host.

**Discussion**

Sixteen (41 %) of 39 *Podarcis muralis* harbored 143 helminths representing 5 species: 10 lizards harbored 1 species, 5 harbored 2 species and 1 harbored 4 species. There were 8.7 ± 9.1 SD (range 1 – 32) helminth individuals per host lizard and 3.5 ± 0.5 SD helminth species per host lizard.

Twelve (67 %) of 16 *P. siculus* harbored 397 helminths representing 1 species: 12 lizards harbored 1 species. There were 33 ± 25.5 SD (range 6 – 115) helminth individuals per host and 24.8 ± 0.5 SD helminth species per host.

There are not helminths in the lizard of the *Ophisops elegans* species.

Of the 147 Turkish reptile species (Uetz, 2019) helminth lists are available for 24 species: *Acanthodactylus harranensis* Baran, Kumlutas, Llanza, Sindaco, Avci and Crucitti, 2005; *Acanthodactylus schreiberi* Boulenger, 1878; *Anatololacerta danfordi* (Gunther, 1876); *Apathya cappadocica* (Werner, 1902); *Darevskia armeniaca* (Meheyl, 1909); *Darevskia bendimahensis* (Schmidtler, Eiselt and Darevsky, 1994); *Darevskia clarkorum* (Darevsky and Vedmederja, 1977); *Darevskia sapphirina* (Schmidtler, Eiselt and Darevsky, 1994); *Darevskia unisexualis* (Darevsky, 1966); *Darevskia uzzellis* (Darevsky and Danielyan, 1977); *Darevskia valentina* (Boettger, 1892); *Eremias pleskei* Nikolsky, 1905; *Eremias strauchi* Kesslser, 1878; *Eremias suphania* Basoglu and Hellmich, 1986; *Iranolacerta brandtii* (De Filippi, 1863); *Lacerta trilineata* Bedriaga, 1886; *Lacerta viridis* (Laurenti, 1768); *Mesalina brevirostris* Blanford, 1874; *Parvilocerta parva* (Boulenger, 1887); *Phoenicolacerta laevis* (Gray, 1883); *Podarcis tauricus* (Pallas, 1814).

This report is the first report the helminth fauna list for *P. muralis* and *P. siculus* in Turkey (Table 1). However, additional studies will be required before the component community of helminths infecting Turkish lizards can be determined. For the 24 species listed above, there are on average 3.4 ± 3.3 SD (range 1 – 11) helminth species per lizard species. Currently, we can say that Turkish lizards are infected by generalist Nematodes, i.e. Nematode species that infect more than one host species. And also Turkish lizard is infected by some Digenea and Cestoda species.

**Authors state no conflict of interest.**

**References**

Andrusko, A.M., Arkov, G.S. (1956): The helminth fauna of lizards from the deserts of central Asia and its ecological character. Seria Biologi., 21: 61 – 71.

Baker, M.R. (1987): Synopsis of the Nematoda parasitic in amphibians and reptiles. Memorial University of Newfoundland, Occasional Papers in Biology, 11: 1 – 325.

Baran, I., Atatur, M.K. (1998): Turkish Herpetofauna (Amphibians and Reptiles). Republic of Turkey Ministry of Environment, Ankara, 214 pp.

Birlik, S., Yildirimhan, H.S., Sumer, N., Kumutas, Y., Ilgaç, C., Guclu, O., Durmus, S.H. (2015): The helminth fauna of Apathya cappadocica (Werner, 1902) (Anatolian Lizard) from Turkey. Helminthologia, 52(4): 310 – 315. DOI: 10.1515/helmin-2015-0049

Birlik, S., Yildirimhan, H.S., Sumer, N., Kumutas, Y., Ilgaç, C., Durmus, S.H., Guclu, O., Candan, K. (2016): Helminth fauna of Lebanon Lizard, *Phoenicolacerta laevis* (Gray, 1838). (Squamata: Lizarda).
certidae) from Southern Turkey. Helminthologia, 53(3): 262 – 269. DOI: 10.1515/helm-2016-0016

BIKLIC, S., YILDIRIMHAN, H.S., KULMUTAS, Y., CANDAN, K., ILGAZ, C. (2017): The first helmminth study on Brandt’s Persian lizard Iranol-acerta brandtii (De Filippi, 1863) (Squamata: Lacertidae) from Van Province, Turkey. Helminthologia, 54: 174 – 178. DOI: 10.1515/helm-2017-0021

BIKLIC, S., YILDIRIMHAN, H.S., ILGAZ, C., KULMUTAS, Y. (2018a): Helminth fauna of spiny tailed lizard, Darevskia rudis (Bediaga, 1886) (Sauria: Lacertidae) from Turkey. Helminthologia, 55: 45 – 51. DOI: 10.1515/helm-2017-0057

BIKLIC, S., YILDIRIMHAN, H.S., ILGAZ, C., KULMUTAS, Y. (2018b): Helminth fauna of Valentin’s lizard Darevskia valentini (Boettger, 1892) (Squamata: Lacertidae) collected from central and eastern Anatolia, Turkey. Helminthologia, 55: 1 – 6. DOI: 10.2478/helm-2018-0005

BISERKOV, V.Y. (1995): New records of nematodes and acanthocephalians from snakes in Bulgaria. C. R. Acad. Bulg. Sci., 48: 87 – 89

BISERKOV, V.Y. (1996): New Records of Platyhelminth Parasites from Snakes in Bulgaria. C. R. Acad. Bulg. Sci., 49: 73 – 75.

BISERKOV, V., KOSTADINOVA, A. (1998): Intestinal helmminth communities in the green lizard, Lacerta viridis, from Bulgaria. J. Helminthol., 72: 267 – 271

BOGDANOV, O.P., LUTTA, A.S., MARKOV, G.S., RIZHIKOV, G.S. (1969): New data on the parasite fauna of Agistrodon halys (Reptilia:Cro-otalidae). Zoologicheskii Zhurnal, 48: 179 – 183

BORKOVCOVA, M., KOPRIVA, J.K. (2004): Parasitic helmminths of reptiles (Reptilia) in south Moravia (Czech Republic). Parasitol. Res., 95: 77 - 78. DOI: 10.1007/s00436-004-1258-6

BRAUN, M. (1902): Fascioliden Der Vögel. Zool. Jahr. 16: 1 - 162.

BYKOVSKAYA-PAILOVSKAYA, I.E. (1953): Fauna of trematodes of birds in west Siberia and its dynamics. Parazitologichesskiy Sbornik, 15: 5 – 117

BYKOVSKAYA-PAILOVSKAYA, I.E. (1962): Trematodes of birds in the fauna of the USSR. Izdatel’stvo Akademii Nauk, Moscow and Lenigrad, Russia. 407 pp.

CAPUSE, I. (1971): Contributions a l’étude des trematodes parasites chez les reptiles du Roumanie [Contributions to the study of parasitic trematodes in reptiles of Romania]. Trav. Mus. Hist. Nat. Gr. Antipa., 11: 33 – 40 (In French)

CARRETERO, M.A., ROCA, V., LARDES, S., FERRERO, A., JORGE, F. (2011): Intestinal helminth parasites of wall lizards, Podarcis vaucheri complex (Sauria: Lacertidae) from Algeria. J. Herpetol., 45(3): 385 – 388. DOI: 10.1670/10-118.1

CHABAUD, A.G., BAII, O.G., POINAR, J.R. (1988): Skrjabinelaia ga-liardi (Nematoda, Seuratoidae): further morphological data and life history. Ann. Parasitol. Hum. Comp., 63: 278 – 284

CHALUPSKY, J. (1954): Plagiorchis blatnensis n. sp. (Plagiorchidae, Trematoda) from the small intestine of Microtus arvalis Pall. Věst. čsl. zool. Spol., 18(3): 181 – 188

DESROCHERS, C., CURTIS, M.C. (1987): The occurrence of gastrointestinal helmminths in dogs from Kuujjuaq (Fort Chimo), Quebec, Canada. C. J. Public Health, 78: 403 – 406

DIDYK, A.S., CANARIS, A.G., KINSSELLA, J.M. (2007): Intestinal helminths of the spotted sandpiper, Actitis macularius (L.), during fall migration in New Brunswick, Canada, with a checklist of helmminths reported from this host. Comp. Parasitol., 74: 359 – 363. DOI: 10.1645/GE-2141.1

DOLLFUS, R.P., DESPORTES, C.A., CHABAUD, G., CAMPANA-ROUGET, Y. (1961): Station experimentale de parasitologie de Richelieu (Indre-et-Loire). Contribution a la faune parasitaire regionale. [Experimental station of parasitology of Richelieu (Indre-et-Loire). Contribution to regional parasitic fauna] Ann. Parasitol. Hum. Comp., 36: 303 – 313 (In French)

DURBININA, M.N., KULAKOVA, A.P. (1960): Materials to parasitofauna of Passeriformes in the delta of the Volga River. Parazit. Sbornik., 19: 344 - 372.

DUGAROV, Z.N., BALDANOVA, D.R., KHANMUEVA, T.R. (2018): Impact of the degree of urbanization on composition and structure of helmminth communities in the mongolian racerunner (Eremias argus) Peters,1869. J. Helminthol., 92: 178–186. DOI: 10.1017/ S0022149X17000268

DUSEN, S., KULMUTAS, Y., ILGAZ, C., YAKU, H., KARADAYI, F. (2013): Helmminth parasites of three racerunner lizards: Eremias pleskei Nikolsky, 1905 (Pleske’s Racerunner-Transcauscasian Racerun-ner), Eremias strauchi Kessler, 1878 (Strauch’s Racerunner) and Eremias suphani Basoglu & Hellmich, 1968 (Suphan Racerun-ner) collected from eastern part of Turkey. Helminthologia, 50(2): 108 – 111. DOI: 10.2478/s11687-013-0117-3

DUSEN, S., KULMUTAS, Y., ILGAZ, C., AYCI, A., GUL, H.Y. (2016): A Helmminthological research on three lacertid lizards species: Acan-thodactylus harranensis Baran et al., 2005, Acanthodactylus schreieri Boulenger, 1878, and Mesalina brevirostris Blandord, 1874, collected from south and south-eastern regions of Turkey. Helminthologia, 53: 200 – 206. DOI: 10.1515/helm-2016-0010

FERRER, D., MOLINA, R., ADELAIXTO, C., KINSSELLA, J.M. (2004): Helminths isolated from the digestive tract of diurnal raptors in Catalo-nia, Spain. Vet. Rec., 154: 17 - 30. DOI: 10.1136/vr.154.1.17

FURMAGA, S. (1956): Plagiorchis stefanskii sp. n. and Plagiorchis raabei sp. n., parasites of field rodents (Rodentia). Acta Parasitol. Polon., 4

GALDÓN, M.A., ROCA, V., BARBOSA, D., CARRETERO, M.A. (2006): Intestinal helmminth communities of Podarcis bocagei and Podarcis carbonelli (Sauria: Lacertidae) in NW Portugal. Helminthologia, 43: 37 – 41. DOI: 10.2478/s11687-006-0008-y

GARCIA-ADELL, G., ROCA, V. (1988): Helminthofauna of lacertids of the Iberian Central Pyrenees. Rev. Ibér. Parasitol., 48: 257 – 267 (In Spanish)

GARCIA-CALVENTE, I. (1948): Revisión del género Pharyngodon y descripción de especies neus [Review of the Pharyngodon gen- us and description of new species]. Rev. Ibér. Parasitol., 8: 367 – 410 (In Spanish)
GEOGIEV, B.B., BISERKOV, V.Y., GENOV, T. (1986): In toto staining method for cestodes with iron acetocarmine. Helminthologia, 23: 279 – 281

GOLDBERG, S.R., BURSEY C.R. (2010): Ophisops elegans (snake-eyed lizard). Endoparasites. Herpetological Review, 41: 495

GOLDIN, E.B. (1975): Helminth Fauna of Crimean Reptiles. Vestn. Zool., 2: 86 – 88

GURELLI, G., GOCEMEN, B., CETIN-DOKGAN, T., ALPAGUT-KESKIN, N. (2007): First record of Mesocestoides spp. Vaillant, 1963 tetrahyridia (Cestoida: Cyclophyllidea) in Anatolian lizard, Anatololacerta danfordi (Gunter, 1876) in Turkey. North-Western J. Zool., 3(2): 96 – 104

HORNERO, M.J., ROCÁ V. (1992a): Helminthofauna De Podarcis lilfordi (Gunter, 1874) (Sauria, Lacertidae) De Los Islotes De Menorca (Islas Baleares, Mediterraneo Occidental. Miscnea. Zool., 2: 86 – 88

HORNERO, M.J., ROCÁ V. (1992b): Redescription of Skjabinodinae mediana (Garcia-Calvente, 1948) (Nematoda: Pharyngodonidae) from the cloaca of Podarcis pityusensis (Bosca, 1883) (Sauria: Lacertidae) of the Balearctic Islands (Spain). Syst. Parasitol., 23: 31 – 35. DOI: 10.1007/BF00008006

IKROMOV, E.K., CHÓ, M.R. (2004): On new representatives of the helminth fauna of reptiles (Testudines and Sauria) in Uzbekistan. J. Asia Pac. Entomol., 7: 13 – 17. DOI: 10.1016/S1226-8615(08)60196-X

KHMUSTENKO, Y.D., ATAEV, C.A. (1979): Find of an Azerbaijan lizard Lacerta raddei in the Turkmen SSR, USSR. Izdatel’stvo Akad. Nauk. Turk. SSR, Series Biology, 6: 72 – 74

KINSELLA, J.M., DÍDYK, A.S., CANARIS, A.G. (2007): Helminths of Hudsonian godwits, Limosa haemastica, from Alaska and Manitoba. J. Parasitol., 93: 716 – 717. DOI: 10.1645/GE-1133R.1

KIRIN, D. (2002a): New data on the helminth fauna of Lacerta viridis Laurenti, 1768, and Podarcis muralis (Laurenti, 1768) (Reptilia: Lacertidae) in Bulgaria. Acta Zool. Bulg., 54: 43 – 48

KRASNOLOBOVA, T.A. (1987): Trematodes of the USSR. Genus Plagiorchis. Nauka, Moscow.

LEWIS, J. (1990): Parasitic worms in a slowworm (Anguis fragilis L.) population from the Bieszczady mountains (Poland). Acta Parasitol. Pol., 35: 207 – 215.

LEWIS, J. (1992a): Parasites of the sand lizard (Lacerta agilis L.) in Poland. Acta Parasitol., 37: 19 – 24

LEWIS, J. (1992b): Parasites of Lacerta vivipara Jacquin, 1787 in Poland. Acta Parasitol., 37: 79 – 82.

LI, H.C. (1934): Report on a collection of parasitic nematodes, mainly from north China. Part II. Spiruroida. T. Am. Micr. Soc., 53: 174 – 195

MACKO, J.K. (1969): Die helminthofauna von Crex crex aus der Ostslowakei [The helminthofauna of Crex crex in East Slovakia]. Helminthologia, 10: 297 – 305 (In German)

MALCZEWSKI, A. (1961): Helminth fauna of bred foxes and mink. Wiad. Parazytol., 7: 283 – 286

MASSINO, B.G. (1927): K opredeleniu vidov roda Plagiorchis Lühe, 1889 [To the determination of species of the genus Plagiorchis Lühe, 1889]. Sborn. Rabot Gelmint. Posv. Skrjabin., 108 – 112 (In Russian)

MASSINO, B.G. (1929): Die Trematoden der gattung Plagiorchis Lühe, 1889, der Vögel Russlands. Beitrag zur Kenntnis der Helminthofauna Russlands [The trematodes of the genus Plagiorchis Lühe, 1889 in birds of Russia. Contribution to the knowledge of the helminth fauna of Russia]. Zentralbl. Bakt., 78: 125 – 142 (In German)

MATTSKÁS, I. (1971): The trematode fauna of rodents and insectivora (Mammalia) in Hungary I. Parasitol. Hung., 4: 125 – 136

MAZIEKA, V., PAULIAUSKAS, A., BALCIUSKAS, L. (2003): New data on the helminth fauna of rodents of Lithuania. Acta Zool. Lit., 13: 41 – 47. DOI: 10.1080/13921657.2003.10512542

MCALLISTER, C.T., CONN, D.B., FRED, P.S., BRUDICK, D.A. (1991): A new host and locality record for Mesocestoides sp. tetrahyridia (Cestoida: Cyclophyllidea), with a summary of the genus from snakes of the world. J. Parasitol., 77: 329 – 331

MEHRA, H.R. (1937): Certain new and already known distomes of the family Lepodermatidae Ochler (Trematoda), with a discussion on the classification of the family. Z. Parasitenk., 9: 429 – 469

MAHSCHE, F.T., KHAMEER, N.R., AL-SAYARI, A.A. (1990): Flat worms (Platyhelminthes) in two species of gull (Larus ichthyaetus and L. canus) from Basrah, Iraq. Zool. Middle East, 4: 113 – 116. DOI: 10.1016/09397140.1990.10637594

MOIRAČ, V. (1963): Plíspěvek k poznání helmintofauny naších plazů [Contribution to the knowledge of helminthofauna of our reptiles]. Spisy Přírodov. Fak. Univ. Brno, 446: 353 – 396 (In Czech)

MUHLING, P. (1896): Beiträge zur kenntnis der trematoden [Contributions to the knowledge of the trematodes]. Arch. Naturg., 62: 118 (In German)

MURAVANDZE, L., LOMITZE, T.S., NIKAISHEVI, K., JANKARASHVILI, E. (2008): The annotated list of reptile helminths of Georgia. Proc. Inst. Zool. Tbilisi, 23: 54 – 61

NEILLI, S., FELIZ, D., MARINE, A. (2014): Seven new species of helminths for reptiles from Armenia. Acta Parasitol., 59: 442 – 447. DOI: 10.2478/s11686-014-0264-9

OEDEHN, K. (1959): Über Plagiorchis, Omphalometra und Allocordium (Trematoda, Digenea) [About Plagiorchis, Omphalometra and Allocordium (Trematoda, Digenea)]. Z. Parasitenk., 19: 442 – 457 (In German)

OEDEHN, K. (1961): Mischeinfectionen mit zwei Plagiorchis-Arten (Trematoda, Digenea) bei einheimischen schlalben und mau-erseglern [Mixed infections with two Plagiorchis species (Trematoda, Digenea) in native swallows and swifts]. S. A. Monatsber Dtsch. Akademie Wiss. Bin. Bd., 3(10): 584 – 589 (In German)

PAIGETT, K.A., BOYCE, W.M. (2004): Life-history studies on two molecular strains of Mesocestoides (Cestoda: Mesocoeostoidae): identification of sylvatic hosts and infectivity of immature life stages. J. Parasitol., 90: 108 – 113. DOI: 10.1645/GE-100R1

PAIVOV, V.V., KARPENKO, S.V. (2004): The population dynamics of the water shrew Neomys fodiens (Mammalia, Soricidae) and its helminths fauna in the Northern Baraba. Parazitologiya, 38: 448
PETROV, A.M., TIKHONOV, P.N. (1927): Novaia trematoda kishchnika domashnikh plotoaidnykh Plagiorchis massino n. sp. Samml. Helminth. Arb. K. 1. Skrjabin gewid. Moscow. pp. 150 – 154
PROKOPIC, J., KRIVANEC, K. (1975): Helminths of amphibians, their interaction and host-parasite relationships. Acta Sci. Nat. Brno., 9: 1 – 48
RADCHENKO, N.M. (1973): New data on the parasites of Agama erythrogastra (Squamata, Agamidae). Zool. Zhurnal, 52: 1398 – 1400.
RAUSCH, R.L., FAY, F.H., WILLIAMSON, F.S.L. (1983): Helminths of the arctic fox, Alopex lagopus (L.) in Greenland. Can. J. Zool., 61: 1847 – 1851. DOI: 10.1139/z83-237
RAUSCH, R.L. (1994): Family Moscestoididae Fuhrmann, 1907. In KHALIL, L.F., JONES, A., BRAV, R.A. (Eds) Keys to the cestode parasites of vertebrates, CAM International, Oxon, U.K. 309 – 314 pp.
ROBERTS, L.S., JANOVY, J. (2000): Gerald D. Schmidt & Larry S. Roberts’ foundations of parasitology, Sixth Edition. McGraw Hill, Boston, Massachusetts. 670 pp.
ROCA, V., LINCH, J., NAVARRO, P. (1986a): Contribución al conocimiento de la helmintofauna de los herpetos ibéricos. V. Parásitos de Psammodromus algirus (L., 1758) Boulenger, 1887, Psammom- dromus hispanicus Fitzinger, 1926 Acanthodactylus erythrurus (Schinz, 1833) Mertens, 1925 (Reptilia: Lacertidae) [Contribution to the knowledge of the helminthofauna of the Iberian herpetofauna. I. Parasites of Psammomdromus algirus (L., 1758) Boulenger, 1887, Psammomdromus hispanicus Fitzinger, 1926 Acanthodactylus erythrurus (Schinz, 1833) Mertens, 1925 (Reptilia: Lacertidae)]. Bol. R. Soc. Esp. Hist. Nat. Secc. Biol., 81: 69 – 78 (In Spanish)
ROCA, V., LINCH, J., NAVARRO, P. (1986b): Contribución al conocimiento de la helmintofauna de los herpetos ibéricos. I. Parásitos de Lacertidae: Lacerta lepida Daudin, 1802 y Podarcis hispanica (Steindacher, 1870) [Contribution to the knowledge of the helminthofauna of the Iberian herpetofauna. I. Parasites of Lacertidae: Lacerta lepida Daudin, 1802 and Podarcis hispanica (Steindacher, 1870)]. Rev. Iber. Parasitol., 46: 129 – 136 (In Spanish)
ROCA, V., GARCIA-ADELL, G., LOPEZ, E., ZAPATERO-ROMAS L.M. (1987): Algunas formas adultas y larvarias de platemintos de reptiles de las Islas Canarias [Some adult and larval forms of reptile flatworms of the Canary Islands]. Rev. Iber. Parasitol., 37: 263 – 270 (In Spanish)
ROCA, V., LLUCH, J. (1988): L’helmintofauna des lacertidae (Reptilia) de la zone thermomediterraneanne de l’est de l’Espagne [The helmintofauna of Lacertidae (Reptilia) of the thermo-Mediterranean area of eastern Spain]. Asp. Ecol. Vie Milieu., 38: 201 – 205 (In French)
ROCA, V., FERRAGUT, M.V. (1989): Helmintofauna del lagarto verdinegro, Lacerta schreiberi Bedriaga, 1878 (Reptilia: Lacertidae) del Sistema Central (España) [The helminth fauna of Lacerta schreiberi in Central Iberia]. Rev. Iber. Parasitol., 49: 291 – 300 (In Spanish)
ROCA, V., LOPEZ-BALAGUER, E., HORRERO, M.J. (1989): Helmintofauna de Podarcis hispanica (Steindacher, 1870) y Podarcis bocagei (Seoane, 1884) (Reptilia: Lacertidae) en el Cuadrante Noroccidental de la Península Ibérica [Helminthofauna from Podarcis hispanica (Steindacher, 1870) and Podarcis bocagei (Seoane, 1884) (Reptilia: Lacertidae) in the North-West of the Iberian Peninsula]. Rev. Ibér. Parasitol., 49: 127 – 135 (In Spanish)
ROCA, V., LOPEZ-BALAGUER, E., HORRERO, M.J. (1990): Skrjabinelazia hoffmanni Li 1934 (Nematoda; Seuratidae) parasite of lizards in the Iberian Peninsula. Bol. R. Soc. Esp. Hist. Nat. Secc. Biol., 86: 125 – 132
ROCA, V., HORRERO, M.J. (1991): Helmintofauna de Podarcis pityusensis (Bosca, 1883) (Sauria: Lacertidae). Rivista Espanola De Helminologia, 5: 77 – 87
ROCA, V., HORRERO, M.J. (1994): Helminth infracomunities of Podarcis pityusensis and Podarcis illoardi (Sauria: Lacertidae) from the Balearic Islands (Western Mediterranean Basin). Can. J. Zool., 72: 658 – 664. DOI: 10.1139/z94-089
ROCA, V. (1995): An approach to the knowledge of the helminth infracomunities of Mediterranean insular lizards (Podarcis spp.). Sci. Herpetol., 285 – 292
ROCA, V., MARTIN, J.E., CARBONELLI, E. (1999): Helminths parasitising endemic geckoes from Canary Islands. Miscnea. Zool., 22: 101 – 108.
ROCA, V., JORGE, F., ILGAZ, C., KUMLUTAS, Y., DURMUS, S.H., CARRETERO, M.A. (2015a): The intestinal helminth community of the spiny-tailed lizard Darevskia rudis (Squamata, Lacertidae) from northern Turkey. J. Helminthol., 90: 144 – 151. DOI: 10.1017/S0022149X14000911
ROCA, V., JORGE, F., ILGAZ, C., KUMLUTAS, Y., DURMUS, S.H., CARRETERO, M.A. (2015b): Are the helminth communities from unisexual and bisexual lizards different? Evidence from gastrointestinal parasites of Darevskia spp. in Turkey. Acta Zool. Acad. Sci. Hung., 61(3): 279 – 288. DOI: 10.17109/AZH.61.3.6.2015
ROCA, V., JORGE, F., ILGAZ, C., KUMLUTAS, Y., DURMUS, S.H., CARRETERO, M.H. (2016): Intestinal parasites of unisexual and bisexual lizards Darevskia spp. (Lacertidae) From northeastern Anatolia. Helminthologia, 53: 298 – 303. DOI: 10.1510/helmin-2016-0021
RUDOLPH, C. (1802): Fortsetzung der beobachtungen über die eingeweidewurmer [Continuation of observations about the intestinal worms]. Arch. Fur Zool. Y. Zoot., 3(1): 61 – 125 (In German)
SANTORO, M., AZIAR, F.J., MATTUCCI, S., KINSELLA, J.M., PELLEGRINO, F., CIPRIANI, P., NASCETTI G. (2013): Parasite assemblages in the western whip snake Hierophis viridiflavus Carbonarius (Colubridae) from southern Italy. J. Helminthol., 87: 277 – 285. DOI: 10.1017/S0022149X12000338
SCHAD, G.A., KUNTZ, R.E., WELLS, W.H. (1960): Nematode parasites from Turkish vertebrates. An annotated list. Can. J. Zool., 38: 949 – 963. DOI: 10.1139/z60-101
SCHMIDT, G.D. (1986): Handbook of tapeworm identification. CRC Press, Boca Raton, Florida. 675 pp.
SEY, O. (1965): A pészmapocok (Ondatra zibethica D. 1776) Mag-
yarorszagi belső élősködő férgei, 1 [The muskrat (Ondatra zibethica D 1776) internal parasitic worms in Hungary]. Vertebrat. Hung., 7: 153 – 175 (In Hungarian)

Sharpilo, V.P. (1962): On the study of the helminth fauna of reptiles Transcaucasia. Zbirnyk Prats’ Zoologichnogo Muzeiu., 31: 63 – 69

Sharpilo, V.P. (1976): Parasitic worms of the reptilian fauna of the USSR. Izdat. ‘Naukova Dumka’, Kiev USSR. 287 pp.

Sharpilo, V.P., Biserkov, V., Kostadinova, A., Behnke, J.M., Kuzmin, Y.I. (2001): Helminths of the sand lizard, Lacerta agilis (Reptilia, Lacertidae), In The palaeartic: faunal diversity and spatial patterns of variation in the composition and structure of component communities. Parasitology, 123: 389 – 400. DOI: 10.1017/S0031182001008587

Shevchenko N. N., Barabashova V. N. (1958): Helminth fauna of Lacerta agilis L. and Vipera berus L. in the Kharkov area. In Skhobalova N. P., Skribina K. I. (Eds): Roboty po gelmintologii k 80-letiiu akademika K. I. Skriabina [Studies on helminthology to the 80th anniversary of academician K. I. Skryabin]. Idatelstvo Akademii Nauk SSR, Moscow, pp. 389 – 394

Shimalov, V.V., Shimalov, V.T., Shimalov, A.V. (2000): Helminth fauna of lizards (Reptilia, Sauria) in the southern part of Belarus. Parasitol. Res., 86: 343. DOI: 10.1007/s004360050057.D

Shimalov, V.V. (2002): Helminth fauna of the striped field mouse (Apodemus agrarius Pallas, 1778) in ecosystems of belorussian Polesie transformed as a result of reclamation. Parasitol. Res., 88: 1009 – 1010

Sitko, J. (1998): Trematodes of birds of prey (Falconiformes) in Czech Republic. Helminthologia, 35: 131 – 146

Styczynska-Jurewicz, E. (1962): The life cycle of Plagiorchis elegans (Rud., 1802) and the revision of the genus Plagiorchis Lühe, 1889. Acta Parasitol. Pol., 10: 419 – 445

Tenora, F., Henttonen, H., Hautakallio, V. (1983): On helminths of rodents in Finland. Ann. Zool. Fennici, 20(1): 37 – 45

Uetz, P. (2019): The reptile database. http://www.reptile-databasse.ru. Accessed 2019 January 19

Ugurtaš, I.H., Yildirimhan, H.S., Oz, M. (2000): Two new localities of Lacerta sicula hieroglyphica Berthold, 1842 (Reptilia, Lacertidae). Turk. J. Zool., 24: 253 – 256

Uhrirova, M. (2005): Comparative study on the fauna of parasitic Oxyuroidea (Nematoda: Oxyuroidea) of reptiles from Azerbaijan and selected areas of the Near East. Helminthologia, 42(3): 171 – 186

Yamaguti, S. (1961): Systema Helminthum. Volume III. The Nematodes of Vertebrates, Part I. Interscience Publishers Inc., New York. 679 pp.

Yildirimhan, H.S., Bursey, C.R., Altunel F.N. (2011): Helminth parasites of the Balkan Green Lizard Lacerta trilineata Bedriaga 1886 from Bursa, Turkey. Turk. J. Zool., 35: 519 – 535. DOI: 10.3906/zoo-0910-1

Zarnowski, E. (1960): Parasitic worms of forest micromammalians (Rodentia and Insectivora) of the environment of Pulawy (District Lublin) II. Trematoda. Acta Parasitol. Pol., 8: 128 – 168