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VERSITA

Seven new species of helminths for reptiles from Armenia

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Abstract

Helminthic infections of reptiles habiting in the territory of Armenia are examined. Seven species of helminths new for reptiles from Armenia are registered: *Parapharyngodon skrjabini*, *Oswaldocruzia goezei*, *Neoxysomatium* sp., *Telorchis assula*, *Nematotaenia tarentolae*, *Mesocestoides lineatus* and *Spirometra erinacei europea*. Descriptions and pictures of them are given.

Keywords

Helminthic infections; *Parapharyngodon skrjabini; Oswaldocruzia goezei; Neoxysomatium* sp.; *Telorchis assula; Nematotaenia tarentolae; Mesocestoides lineatus; Spirometra erinacei europea*

Introduction

Knowledge of helminths infecting wild animals is interesting for understanding more about the ecology, diet, life cycle and evolution of both helminths and hosts (Silva *et al*., 2008). Reptiles are a large class of vertebrates distributed in different biocoenosis and constituted the principal components of them. Being definitive, intermediate and paratenic hosts for helminths there are important links in helminths circulation.

Although 51 reptilian species have been reported for Armenia, few of them have been examined for helminths. Data about helminthic infections of reptiles of this region area scarce and fragmented (Sharpilo, 1976; Ghazaryan, 2000, 2001; 2003, Vartanyan, 2011). First studies in this are was carried out by Sharpilo in 1976, who investigated many parasites of reptiles of the former USSR (included Armenia) and after that no summarized survey in this area were made.

The purpose of this article is to provide the list and description of some helminth species of lizards and snakes of Armenia.

Materials and Methods

During 2009–2012 years 226 specimens of reptiles belonging to 20 species were collected. They are 14 species of lizards: *Darevskia armeniaca* (n = 29), *D. dahli* (n = 5), *D. raddei* (n = 78), *D. portschinski* (n = 7), *D. rostombekovi* (n = 5), *D. unisexualis* (n = 14), *D. valentini* (n = 18), *Lacerta agilis* (n = 15), *Lacerta media* (n = 5), *L. strigata* (n = 4), *Ophisops elegans* (n = 7), *Eremias strauchi* (n = 4), *Pseudopodus apodus* (n = 3), *Anguis colchica* (n = 1) and 6 species of snakes: *Natrix tessellata* (n = 16), *Macrovipera lebetina* (n = 6), *Coronella austriaca* (n = 4), *Malpolon monspessulanus* (n = 2), *Platyceps nayadum* (n = 2), *Hemorrhois ravergieri* (n = 1).

Some of the reptiles were killed by anesthetic (chloroform) and their internal organs were examined for helminths. All experiments on reptiles published in this article were done in accordance with the standards of the responsible committee on animal research and ethics. Other specimens examined only externally and many helminths were taken from the cloaca.

In laboratory conditions the body cavity of each reptile was opened by a longitudinal incision from throat to vent, the gastrointestinal tract was slit longitudinally, and stomach and intestinal contents were removed and examined under the microscope. In the gastrointestinal tract, lungs, or body cavity found helminths were placed in 70% ethanol solution for later identification. For species identification, *Nematodes* were initially placed in glycerin or glycerin-lactic acid mixture (1:1). *Cestodes*, *Trematodes* and *Acanthocephales* were stained with carmine, washed in water, three times hydrolyzed by ethanol solutions series (70%, 80% and 96%), put in pink balm for brightening and mounted in balsam.

Morphology of the parasites was examined under a dissecting microscope by 40 and 100 magnification. Identification of helminths was carried out according to Sharpilo (Sharpilo, 1976).

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Table I. Data about 12 identified species of helminths

Helminth species	Host species	Number of detected specimens
Spauligodon saxicolae Sharpilo, 1961 (*Nematoda*, *Oxyuridae*)	*Darevskia armeniaca*, *D. dahli*, *D. portschinski*, *D. raddei*, *D. unisexualis*, *D. valentini*	24
Spauligodon lacertae Sharpilo, 1966 (*Nematoda*, *Oxyuridae*)	*Lacerta agilis*, *L. strigata*	15
Parapharyngodon skrjabini Vakker, 1969 (*Nematoda*, *Oxyuridae*)	*Pseudopodus apodus*	38
Hexadontophorus ophisauri Kreis, 1940 (*Nematoda*, *Rhabdiasidae*)	*P. apodus*	14
Oswaldocruzia goezei Skrjabin et Schulz, 1952 (*Nematoda*, *Trichostrongylidae*)	*L. media*	15
Neoxysomatium sp. Ballesteros Marquez, 1945 (*Nematoda*, *Cosmocercidae*)	*P. apodus*, *Anguis colchica*	14
Telorchis assula Dujardin, 1845 (*Trematoda*, *Telorchidae*)	*Natrix tessellata*	28
Nematotaenia tarentolae Lopez-Neyra, 1944 (*Cestoda*, *Nematoteniidae*)	*D. armeniaca*, *D. rostombekovi*, *D. valentini*	12
Ophiotaenia europea Odening, 1963 (*Cestoda*, *Ophiotaeniidae*)	*N. tessellata*, *Macrovipera lebetina*	16
Mesocestoides lineatus Goeze, 1782 (*Cestoda*, *Mesocestoidiidae*)	*Ophisops elegans*, *L. media*, *L. agilis*	100
Spirometra erinacei europea Rud., 1819 (*Cestoda*, *Diphyllobothriidae*)	*N. tessellata*, *M. lebetina*	4
Macracanthorhynchus catulinus Kostilew, 1927 (*Acanthocephales*, *Olygacanthorhynchidae*)	*D. valentini*	5

Results

Morphological analysis of uncovered helminths identified 12 species. Data about them are given in the Table I.

Following seven species of helminths: *Parapharyngodon skrjabini*, *Oswaldocruzia goezei*, *Neoxysomatium* sp., *Telorchis assula*, *Nematotaenia tarentolae*, *Mesocestoides lineatus* and *Spirometra erinacei europea*, first time registered for reptiles of Armenia. Descriptions of mentioned species are given below.

***Parapharyngodon skrjabini* Vakker, 1969 (Nematoda, Oxyuridae)**

Type host: *Pseudopodus apodus*

Site of infection: small and large intestines, cloaca

Description (based on 8 female specimens): Body length 7.2 ± 0.2 mm. Maximum width of body 1.4 mm, while in the region of lips 0.17 mm, and in the cloaca 0.8 mm (Fig. 1A).

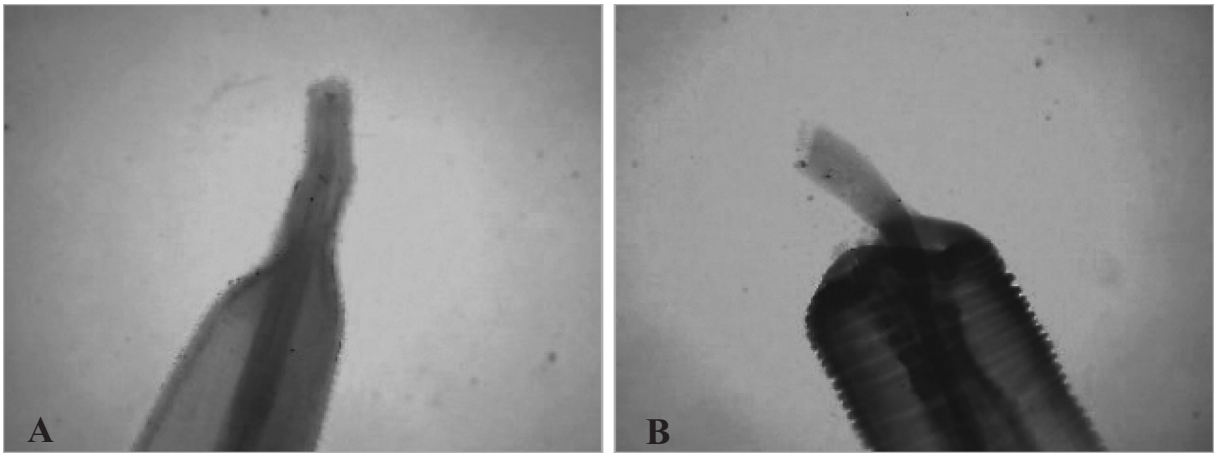

Fig. 1. A – anterior; **B** – posterior ends of *Parapharyngodon skrjabini*

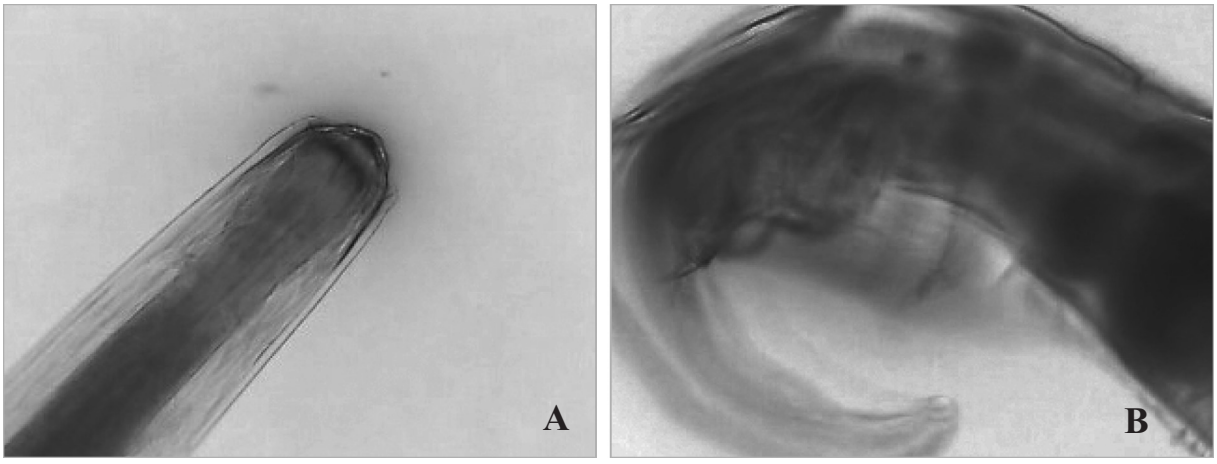

Fig. 2. A – anterior; **B –** posterior ends of *Oswaldocruzia goezei*

Cuticle thin with longitudinal striations. Esophagus length is 1.1 mm. Glandular region 0.2 mm long and 0.17 mm wide. The beginning of intestine is extended. Excretory pore is in 2 mm distance from anterior end of the body. The posterior end of the body ends with blunt spine (Fig. 1B). Tail length 0.21mm, wide 0.1 mm. Papillas on the tail are absent.

***Oswaldocruzia goezei* Skrjabun et Schulz, 1952 (Nematoda: Strongylidae)**
Type host: *Lacerta media*

Site of infection: small and large intestines

Description (based on 12 specimens): Length of body 8.6–12.4 mm, maximum width of body 0.19 mm. Cuticle is longitudinal striated (Fig. 2A). Oral opening has 4 papillaries. Buccal capsule has 0.06–0.08 mm deep and 0.051mm maximum wide. Esophagus length 0.04–0.045 mm. Muscular region ends with enlarged glandular region. Excretory pore is about 0.25mm distance from the anterior end of the body. Length of bursa is 0.25–0.27, width 0.16–0.18 mm. Spicules are large and have 0.06–0.07 mm length. Tale conical, 0.2 mm long (Fig. 2B). Distance from the posterior end of the body to vulva is 4.4 mm. Eggs have delicate glassy membrane and 0.01 × 0.05 mm dimensions.

***Neoxysomatium* sp. Ballesteros Marquez, 1945 (Nematoda: Cosmocercidae)**
Type host: *Pseudopodus apodus*, *Anguis fragilis*

Site of infection: small and large intestines

Description (based on 8 specimens): Body length 4.8–5.0 mm, maximal width 0.2 mm (Fig. 3A). Cuticle thin with longitudinal striations. Esophagus length 0.7–0.8 mm. Muscular region is 0.07–0.09 mm and glandular region 0.9–1.0 mm wide. In the posterior end of esophagus begins extended intestine. Excretory pore is about in 0.45 mm distance from anterior end of the body. Tail is curved, 0.13 mm long. In the posterior end of the body are many papillas. In caudal part have special

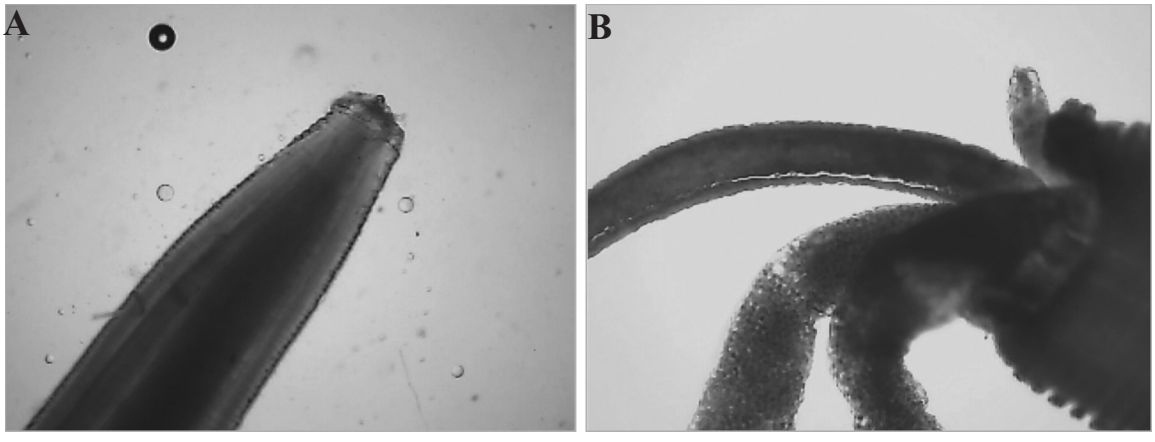

Fig. 3. A – anterior; **B –** posterior ends of *Neoxysomatium* sp.

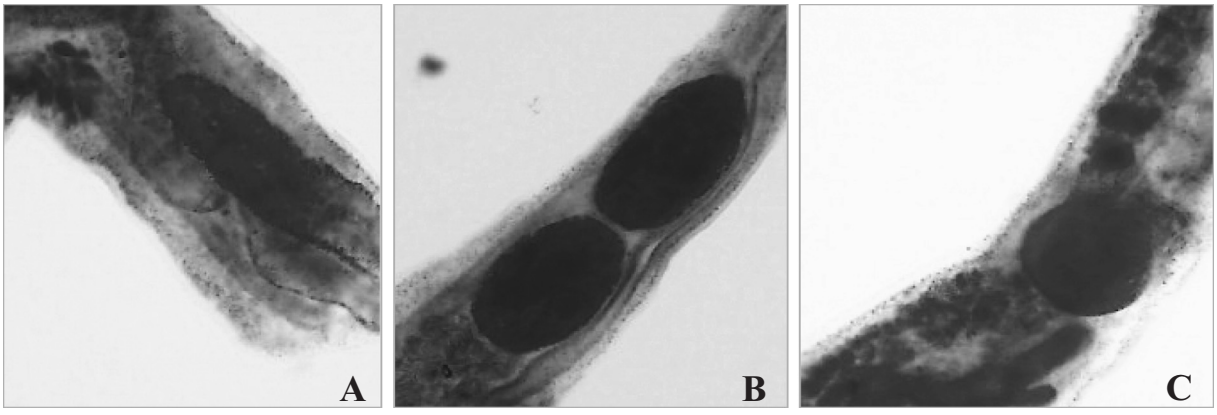

Fig. 4. A – oral sucker; **B –** testes; **C –** ovary of *Telorchis assula*

copulative organ hibernacula (Fig. 3B), which have 2 mm maximal length.

***Telorchis assula* Dujardin, 1845 (Trematoda: Telorchidae)**
Type host: *Natrix tessellata*

Site of infection: small and large intestines

Description (based on 5 specimens): Body elongate, 4–4.9 mm long, 0.3–0.4 mm wide. Maximum wide is near the acetabulum (ventral sucker). Tegument is spiny. Oral sucker subterminal, nearly round, 0.11 mm long (Fig. 4A), ventral sucker 0.09 mm. Oral sucker-ventral sucker ratio: 1:0.81. Distance between oral sucker and ventral sucker centers 0.14 mm. Esophageal bifurcation is in the middle of suckers. Testes are postacetabular. Anterior testis is 0.24 mm long, 0.16 mm wide (Fig. 4B). Posterior testis is 0.27 mm long, 0.16 mm wide. Distance from posterior testis to posterior end of the body is 0.4 mm. Cirrus is elongated, curved and closely to ovary. Ovary is nearly round, 0.15 mm long, 0.147 mm wide (Fig. 4C). Vitelline fields are located laterally. Uterus has raised branches. Eggs are small, 0.02 mm long, 0.16 mm wide.

***Nematotaenia tarentolae* Lopez-Neyra, 1944 (Cestoda, Nematotaeniidae)**
Type host: *Darevskia armeniaca*, *D. valentini*, *D. rostombekovi*

Site of infection: small and large intestines

Description (based on 9 specimens): Strobila consists of more than 250 proglottides. Body length 30–40 mm, maximum width 0.5 mm. Scolex width 0,16 mm. There are 4 suckers in scolex. They are spherical to oval in shape and have 0.07 mm long and 0.07 mm wide. Immature proglottides' length 0.08 mm, width 0.04 mm. Mature proglottides length 0.09 mm, width 0.055 mm. Pregravid proglottides long is 0.45 mm, wide 0.4 mm (Fig. 5A). Gravid proglottides has 0.5 mm long and 0.24 mm wide (Fig. 5B). Genital pores are altering irregularly.

Testes are spherical or oval. Testes length is 0.07 mm, wide 0.015 mm. Ovaries have 0.04 mm wide and 0.5 mm long. Vitellines are oval. There are 25–31 eggs in every gravid proglottide. Every egg is surrounding by paruterine organ. Paruterine organ has 0.03 mm wide and 0.07 mm long. Gravid proglottides are separated from strobila and can move themselves (Sharpilo, 1976).

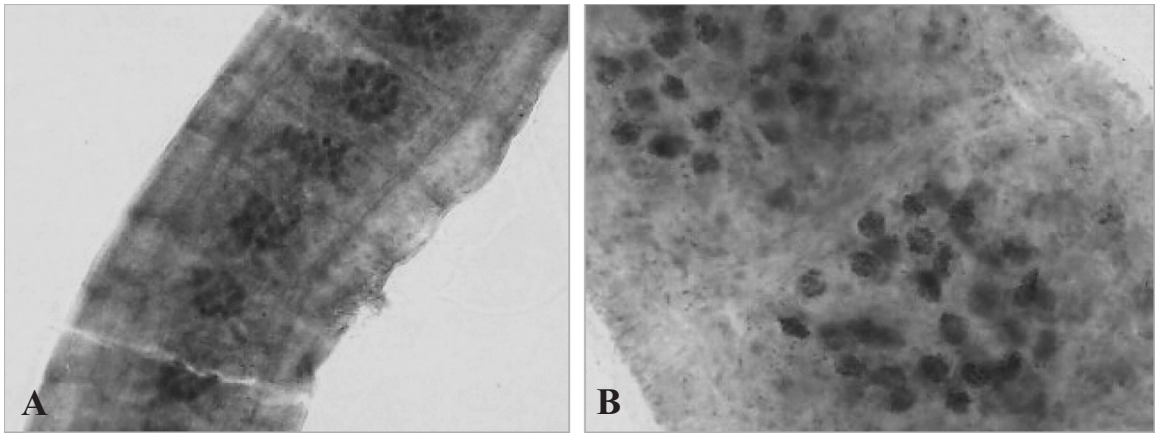

Fig. 5. A – pregravid; **B –** gravid proglottides of *Nematotaenia tarentolae*

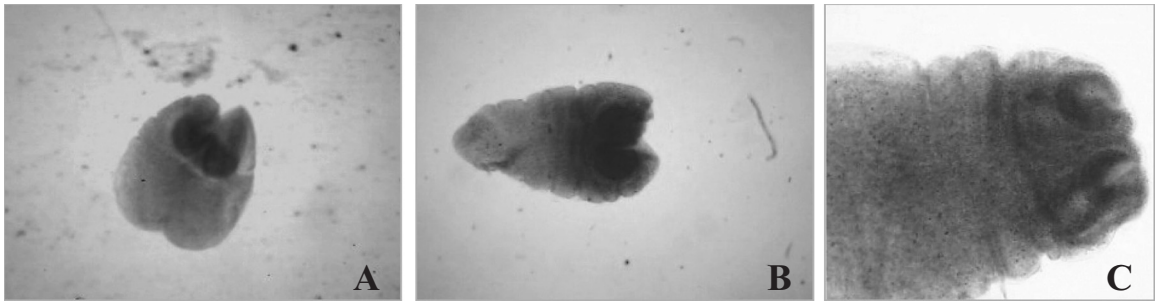

Fig. 6. Different stages of *Mesocestoides lineatus*, larvae

***Mesocestoides lineatus* Goeze, 1782 (*Cestoda, Mesocestoidea*), Larvae**
Type host: *Ophisops elegans*, *Lacerta agilis*, *L. media*

Site of infection: body cavity

Description (based on 12 specimens): Larval stage of this helminth called tetratiridium is parasite of reptiles. Larvae have different shape: spherical, oval or linguiform (Fig. 6A, 6B). The posterior end of body is sharpened. Body length is 0.5–1.2 mm. There are many folds in the surface of tegument. In the anterior end of the body is funnel-shaped recess, which originated by invaginated scolex (Fig. 6C). In cervical part are zigzagging folds. Suckers are oval and have 0.016 mm wide and 0.1 mm long. There are limy grains in parenchimatous tissue. Larvaes are in bindweb capsules. In two lateral sites of body are excretory vessels, the maximum wide of which is 0.025 mm.

***Spirometra erinacei europea* Rud, 1819 (*Cestoda: Diphyllobotriidae*), Larvae**
Type host: *Natrix tessellata*, *Macrovipera lebetina*

Site of infection: body cavity
Description (based on 3 specimens): Larval stages of this *Cestode* called plerocercoides are parasitizing in reptiles. It's milky. Body length is 5–7 mm. Helminths 3–8 times are shortened and width considerably rises in saline. In scolex are situated bothridial fissure, which have 0.2 mm width and 0.4 mm length (Fig. 7). Cuticle is well developed. Its thickness 0,007–0,008 mm. Willus in cuticle are absent. Larvae can live in water and saline long time.

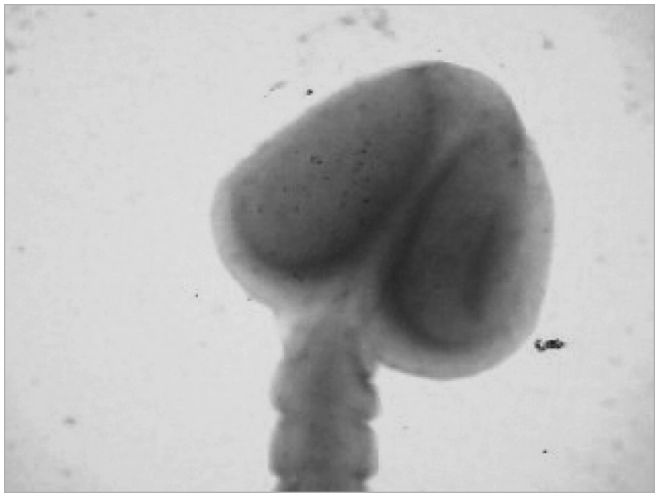

Fig. 7. Scolex of *Spirometra erinacei europea*, larvae

Discussion

This was the first summarized investigation on helminth fauna of reptiles in the territory of Armenia after Sharpilo (Sharpilo, 1976). Totally 12 species of helminths were detected and 7 of them first time registered in Armenia.

Parapharyngodon skrjabini (Vakker, 1969) previously was found only in Kazakhstan. The host was *Pseudopodus apodus*. In 1969 this species was described by Vakkker as a common parasite of grass lizard (Vakker, 1969). Prevalence of infection in Kazakhstan was 18.7%. According to our data prevalence of infection is 66.7%, which can be due to the small number of examined individuals. Intensity of infection is very high 56–60.

Oswaldocruzia goezei (Skrjabun et Schulz, 1952) species previously was found in Russia, Ukraine, Belarus, Azerbaijan and Georgia (Sharpilo, 1976). Hosts are *Lacerta agilis*, *Lacerta strigata*, *Lacerta media*, *Anguis colchica*, *Natrix natrix*, *Natrix tessellata*, *Coronella austriaca* and *Vipera berus*. We found this species only in *Lacerta media*. Prevalence of infection in adjacent territories of Ukraine was 100%. According to our data prevalence of infection was 40%, intensity of infection 5–6.

Neoxysomatium sp. (Ballesteros Marquez, 1945) species previously was found in Russia, Azerbaijan, Georgia, Ukraine, Belarus, England, Poland, Turkey and France (Jones, 2012; Sharpilo, 1974). Hosts are *Anguis colchica*, *Natrix natrix* and *Vipera berus.* Prevalence of infection in examining territories was about 95%. According to our data prevalence of infection of *Anguis colchica* was 33.3%, intensity 5–7.

Telorchis assula (Dujardin, 1845) previously was found in Russia, Ukraine, Belarus, Georgia, Bulgaria, Germany, Poland and North America (Kirin, 2001; Yildirimhan, 2007; Mihalca, 2011; Bakiev, 2011). Hosts are *Natrix natrix*, *Natrix tessellata*, *Vipera berus*, *Vipera ursine* and *Pseudopodus apodus*. Prevalence of infection was about 80%. We found this species

in Dice snake (*Natrix tessellata*). Prevalence of infection according to our data is 12.5%, intensity 15–20.

Nematotaenia tarentolae (Lopez-Neyra, 1944) previously was found in Russia, Ukraine, Georgia, Spain, Italy and France (Sharpilo, 1973; Roca, 1994). Hosts are *Lacerta agilis* and rock lizards of genus *Darevskia*. This species have restricted distribution. We found it in rock lizards of genus *Darevskia.* Prevalence of infection according to our data is 11%, intensity 4–7.

Mesocestoides lineatus, Larvae (Goeze, 1782) species previously was found in Ukraine, Azerbaijan, Bulgaria and Mongolia (Conn, 1984, 1988; Swiderski, 1999; Miguel, 2007). Hosts are *Pseudopodus apodus*, *Agama transcaucasica*, *Lacerta agilis*, *Lacerta media*, *Vipera ursine*. This species generates very high infestation. We found it in *Lacerta agilis*, *Lacerta media* and *Ophisops elegans.* Prevalence of infection according to our data is 42%, intensity 40–110:

Spirometra erinacei europea, Larvae (Rud, 1819) previously was found in Russia, Ukraine, Belorussia, Azerbaijan, Korea and Japan (Sohn, 1993; Kawakami, 1996; Haoran, 1997). Hosts are *Natrix tessellata*, *Natrix natrix*, *Vipera berus* and *Macrovipera lebetina*. We found this species in *Natrix tessellata* and *Macrovipera lebetina*. According to our data prevalence of infection was 16%, intensity 1–3.

Studies in the area of detecting and describing the helminthofauna of reptiles of Armenia are in progress.

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