New records of trematode and acanthocephalan species in frogs in Erzurum Province, Turkey

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Summary

A total of 32 frogs of two species (Rana macrocnemis, Pelophylax ridibundus) that were dissected in some lectures in Ataturk University Science Faculty Biology Department were investigated parasitologically even after the lectures between 2008 and 2014. 9 digenean species (Cephalogonimus retusus [Cephalogonimidae]; Diplodiscus subclavatus [Paramphistomidae]; Gorgodera cygnoides, Gorgoderina vitelliloba [Gorgoderidae]; Haplopora cylindracea, Haematoloechus variegatus, Opisthiothele ranae, Skrjabinoeces similis and Skrjabinoeces breviansa [Plagiorchiidae]), 3 acanthocephalans species (Acanthocephalus ranae, Centrorhynchus sp., Pomphorhynchus laevis) were found. All the parasites are the first record for Erzurum province, Cephalogonimus retusus and Skrjabinoeces similis are the first records of the parasite fauna of Turkey.

Keywords: Anura; Helminths; Erzurum; Turkey

Introduction

The herpetofauna of Turkey consists of 157 species. 14 of those are newts and 14 are frogs (Baran et al., 2012). As a component of the ecosystem frogs can harbour several parasites. There are numerous studies on parasites of amphibians in Turkey as well as all over the world. In the light of the literature, it is figured out that parasites of 24 amphibian species of 29 different provinces of Turkey were investigated but frogs from Erzurum have not been studied for now (Fig. 1).

The study aims to evaluate the dissected frogs used as lecture materials and contribute to the parasite fauna of Turkey.

Material and Method

Between 2008 and 2014, a total of 32 frogs from Erzurum province of 2 species that were etherized and dissected in the Vertebrate Laboratory and the Zoology Laboratory lectures were investigated parasitologically even after. The visceral organs of the frogs, that were died with high-dose ether and dissected, were put into the petri dishes filled with saline water. After the macro investigation, parasites were separated from tissues with needles, forceps and tiny brushes. The trematodes and acanthocephalans were relaxed with an Alcohol-Formalin-Acidic Acid mixture and mounted in Canada balsam according to Pritchard and Kruse (1982). The description of the parasites was executed under the light of the literature (Skrjabin, 1947, 1949, 1950, 1952, 1953, 1962, 1974; Prudhoe & Bray, 1982) and description of the frogs was done according to Budak and Göçmen (2008).

Ethical Approval and/or Informed Consent

This study was approved by Ataturk University Local Ethics Council Of Animal Experiments Erzurum/TURKEY (36643897-118).

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Results and Discussion

A total of 32 frogs of 2 species were investigated and 149 parasites of 12 species were found. While one of *Rana macrocnemis* (17%) didn’t harbour any parasite species, 4 of *Pelophylax ridibundus* (15%) were found parasite free. Of the investigated frogs, 27 (84%) harboured one or more helminth parasites. One of the *P. ridibundus* was parasitized with 5 different helminth species. *Acanthocephalus ranae* is the most prevalent parasite (34%). 3 different helminth species were come across in *Rana macrocnemis*.

**Table 1.** Statistical data of parasites of *R. macrocnemis* and *P. ridibundus*

| HOST             | PARASITE                  | IFN | TPN | PREV | MA   | MI  |
|------------------|---------------------------|-----|-----|------|------|-----|
| *Rana macrocnemis* (n=6) | **D** Dolichosaccus rastellus | 2   | 34  | 33   | 17.0 | 5.7 |
|                   | Haplometra cylindracea    | 2   | 10  | 33   | 5.0  | 1.7 |
|                   | Gorgodera cygnoidei      | 1   | 2   | 17   | 2.0  | 0.3 |
|                   | **A** Acanthocephalus ranae | 1   | 4   | 17   | 4.0  | 0.7 |
| *Pelophylax ridibundus* (n=26) | **D** Cephalogonimus retusus | 3   | 4   | 12   | 1.3  | 0.2 |
|                   | Diplodiscus subclavatus  | 5   | 24  | 19   | 4.8  | 0.9 |
|                   | Gorgodera cygnoidei      | 5   | 11  | 19   | 2.2  | 0.4 |
|                   | Gorgoderina vitelliloba  | 1   | 1   | 4    | 1.0  | 0.01|
|                   | Haematoloechus variegatus | 1   | 2   | 4    | 2.0  | 0.1 |
|                   | Opisthiglypha ranae      | 5   | 31  | 19   | 6.2  | 1.2 |
|                   | Skrjabinoeces similis    | 1   | 2   | 4    | 2.0  | 0.1 |
|                   | Skrjabinoeces breviansa  | 1   | 1   | 4    | 1.0  | 0.1 |
|                   | **A** Acanthocephalus ranae | 10  | 17  | 38   | 1.7  | 0.7 |
|                   | Centrorhynchus sp.       | 1   | 3   | 4    | 3.0  | 0.1 |
|                   | Pomphorhynchus sp.       | 3   | 4   | 12   | 1.3  | 0.2 |

(IFN: Infected Frog Number; TPN: Total Parasite Number; PREV: Infection rate; MA: Mean Abundance; MI: Mean Intensity; D: Digenea; A: Acanthocephala; N: Nematoda)
while 11 parasite species were found in Pelophylax ridibundus. (Table 1), (Figs. 2, 3).

**Platyhelminthes**

**Digenea**

**Cephalogonimidae**

**Cephalogonimus retusus** (Dujardin, 1845)

**Synonym:** Cephalogonimus europaeus

**Host:** Pelophylax ridibundus

**Site of infection:** Bladder

**Geographic range:** Czechoslovakia, Germany, Iran, Russia, Tatarstan, Turkey

**Remarks:** Cephalogonimides are parasites of chelonian reptiles and amphibians, the intermediate host is Helisoma sp. (Gastropoda) (Prudhoe & Bray, 1982).

The body is 4 mm in length and covered with spines. Testicles are just behind the ventral sucker and anterior half of the body. The ovary is pretesticular, and the uterus reaches the posterior end. The vitelline glands are located between the pharynx and the level of the posterior margin of the rear testis (Fig. 2e).

Cephalogonimus retusus was recorded before in Pelophylax esculentus (Lühe, 1909b; Dawes, 1946; Walton, 1949; Vojtkova & Vojtek, 1975; Bray et al., 2005; Rana temporaria (Vojtkova & Vojtek, 1975); Natrix tessellata (Buchvarov et al., 2000); Malpolon monspessulanus and Coluber jugularis (Kirin, 1994).

In the study, morphological and anatomical features of C. retusus was convenient with those mentioned by Skrjabin (1950). C. retusus was recorded only in the intestine of P. ridibundus and the infection rate was 12 %. It is found in Turkey for the first time.

**Gorgoderidae**

**Gorgodera cygnioides** (Zeder, 1800)

**Synonym:** Distomum cygnioides

**Host:** Pelophylax ridibundus, Rana macrocnemis

**Site of infection:** Bladder

**Geographic range:** Czechoslovakia, Germany, Poland, Russia, Tatarstan, Turkey

**Remarks:** Gorgoderids are small and non-spinous trematodes and found in fishes, amphibians and reptiles but Gorgodera and Gorgoderina live in amphibians (Prudhoe & Bray, 1982).

The body is 6.5 mm long. The ventral sucker is distinctly larger than the oral sucker. Testes are divided into nine follicles arranged in two longitudinal rows. The ovary is pretesticular. Vitelline glands are located at the anterior region of the ovary and form two symmetrically disposed oval masses (Fig. 2f).

Gorgodera cygnioides was found before in Bombina bombina and Bombina variegata (Vojtkova & Vojtek, 1975); Bufo igneus (Gurtt, 1845); Pelodytes caucasicus (Yildirimhan et al., 2009); Pelophylax esculentus (Lühe, 1909b; Dawes, 1946; Walton, 1949; (Vojtkova & Vojtek, 1975; Gurtt, 1845; Andre, 1913; Yildirimhan et al., 2005; Duşen & Öz, 2006; Chikhlyaev et al., 2009a; Duşen et al., 2010; Popiolek et al., 2011); Pelophylax lessonae (Vojtkova & Vojtek, 1975; Popiolek et al., 2011); Pelophylax ridibundus (Vojtkova & Vojtek, 1975; Popiolek et al., 2011; (Koyun et al., 2015); Rana arvalis (Vojtkova & Vojtek, 1975); Rana camerani (Yildirimhan et al., 2006a); Rana dalmatina (Yildirimhan et al., 2016); Rana temporaria (Lühe, 1909b; Dawes, 1946; Vojtkova & Vojtek, 1975; Andre, 1913; Linstow, 1878)).

In the study, anatomical and morphological features of G. cygnioides was the same as those given by Skrjabin (1952). G. cygnioides was recorded in the urinary bladder of both R. macrocnemis (n=11, 17 %) and P. ridibundus (n=2, 19 %). G. cygnioides has been found in some provinces of Turkey before but in Erzurum, it is the first record.

**Gorgoderina vitelliloba** (Olsson, 1876)

**Synonym:** Distomum vitellilobum, Distomum cygnioides juv. Gorgoderina simplex, Gorgodera vitelliloba

**Host:** Pelophylax ridibundus

**Site of infection:** Urinary bladder

**Geographic range:** Czechoslovakia, Germany, Iran, Russia, Tatarstan, Turkey

**Remarks:** Gorgoderina vitelliloba is a parasite of the urinary bladder of amphibians (Prudhoe & Bray, 1982).

The body is almost 2.5 mm and non-spinous. The ventral sucker is larger than the oral one. Testes are large and located at the posterior half of the body. The ovary is lobed and pretesticular. Vitelline glands are situated in the anterior region of the ovary (Fig. 2c).

Gorgoderina vitelliloba is detected formerly in Bombina bombina and Bombina variegata (Vojtkova & Vojtek, 1975); Pelophylax esculentus (Lühe, 1909b; Dawes, 1946; Walton, 1949; Vojtkova & Vojtek, 1975; Chikhlyaev et al., 2009a; Chikhlyaev et al., 2009b; Rezvantseva et al., 2010); Pelophylax bedriagae (Demir et al., 2015); Pelophylax ridibundus (Walton, 1949; Yildirimhan et al., 2005; Duşen & Öz, 2006; Duşen et al., 2010; Koyun et al., 2015; Sağlam & Arıkan, 2006; Saeed et al., 2007; Rezvantseva, 2008; Rezvantseva, 2009; Duşen & Öz, 2010; Karakas, 2015); Rana arvalis (Vojtkova & Vojtek, 1975); Rana camerani (Yildirimhan et al., 2006a); Rana macrocnemis (Yildirimhan et al., 1997a); Rana temporaria (Linstow, 1878; Lühe, 1909b; Dawes, 1946; Vojtkova & Vojtek, 1975).

Gorgoderina vitelliloba were found in Pelophylax bedriagae, Pelophylax esculentus, Pelophylax ridibundus, Rana camerani and Rana macrocnemis from some provinces of Turkey. According to Skrjabin (1953) length of G. vitelliloba is 6 – 8 mm but in the study, the specimen recorded in the urinary bladder of P. ridibundus was 2.5 mm in length. Other morphological and anatomical features are the same as those given in the literature mentioned before. The infection rate is 4 %. It is found in frogs of Erzurum province for the first time.
Fig. 2. Digenean parasites of frog from Erzurum (a: Diplodiscus subclavatus, b: Dolichosaccus rastellus, c: Gorgoderina vitelliloba, d: Opisthioglyphe ranae, e: Cephalogonimus retusus, f: Gorgodera cygnoidea, g: Skrjabinoeces breviansa, h: Haplometra cylindracea, i: Haematoloechus variegatus, j: Skrjabinoeces similis).
Paramphistomidae

*Diplodiscus subclavatus* (Goeze, 1782)

**Synonym:** *Planaria subclavatus*, *Amphistomum subclavatum*

**Host:** *Pelophylax ridibundus*

**Site of infection:** Large intestine, rectum

**Geographic range:** Africa, Austria, Bulgaria, Czechoslovakia, England, Iran, Italy, Moldova, Russia, Serbia, Swiss, Tatarstan, Turkey.

**Remarks:** *Diplodiscus subclavatus* (Goeze, 1782) lives in the rectum and intestine of frogs (Prudhoe & Bray, 1982). Nonsinuous body is 2 mm long. The ventral sucker is very large and located at the posterior end of the body. The single testis is situated at the median line and anterior of the ovary. Vitelline follicles extend along the caeca (Fig. 2a).

It was previously encountered in *Bombina bombina* (Lühe, 1909b; Vojtkova & Vojtek, 1975; Gurtl, 1845; Diesing, 1835; Diesing, 1851); *Bombina variegata* (Vojtkova & Vojtek, 1975); *Bufo sp.* (Skrjabin, 1916); *Bufo bufo* (Dawes, 1946; Vojtkova & Vojtek, 1975); *Bufo cinereus* (Diesing, 1835); *Bufo viridis* (Lühe, 1909b; Vojtkova & Vojtek, 1975; Linstow, 1878; Diesing, 1851); *Bufo vulgaris* (Lühe, 1909b; Gurtl, 1845; Linstow, 1878); *Dicroglossus occipitalis* (Maeder, 1973); *Dendrohyas viridis* (Diesing, 1835); *Esox lucius* (Öztürk et al., 2000); *Hyla arborea* (Lühe, 1909b; Vojtkova & Vojtek, 1975; Gurtl, 1845; Linstow, 1878; Diesing, 1835); *Hyla savignyi* (Yildirimhan et al., 2012); *Leptodactylus sibilatrix* (Gurtl, 1845; Linstow, 1878; Diesing, 1835; Diesing, 1851); *Molge alpestris* and *Molge vulgaris* (Lühe, 1909b); *Natrix natrix* and *Natrix tessellata* (Buchvarov et al., 2000); *Pelobates fuscus* (Ruchin et al., 2008; Ruchin et al., 2009; Vojtkova & Vojtek, 1975); *Pelophylax esculentus* (Lühe, 1909b; Dawes, 1946; Vojtkova & Vojtek, 1975; Gurtl, 1845; Andre, 1913; Popiołek et al., 2011; Diesing, 1835; Diesing, 1851; Stossich, 1890; Bjelić-Čabrilo et al., 2009; Chikhlyaev et al., 2009b); *Pelophylax lessonsae* (Vojtkova & Vojtek, 1975; Popiolek et al., 2011); *Pelophylax bedriagae* (Demir et al., 2015); *Pelophylax ridibundus* (Vojtkova & Vojtek, 1975; Erhan & Gherasim, 2015; Yildirimhan et al., 2005; Düşen & Öz, 2006; Chikhlyaev et al., 2009a; Düşen et al., 2010; Popiołek et al., 2011; Koyun et al., 2015; Rezvantseva et al., 2010; Rezvantseva, 2008; Rezvantseva, 2009; Oğuz et al., 1994; Mashaii et al., 2000; Romanova et al., 2010; Indiryakova et al., 2012); *Phryne vulgaris* (Diesing, 1851); *Rana arvalis* (Vojtkova & Vojtek, 1975; Ruchin et al., 2009); *Rana dalmatina* (Vojtkova & Vojtek, 1975; Düşen et al., 2009); *Rana temporaria* (Lühe, 1909b; Dawes, 1946; Vojtkova & Vojtek, 1975; Gurtl, 1845; Linstow, 1878; Diesing, 1835; Diesing, 1851); *Salamandra maculate* (Gurtl, 1845); *Triton alpestris* (Linstow, 1878); *Triturus vulgaris* (Dawes, 1946). *Diplodiscus subclavatus* was recorded in some frogs i.e. *Hyla savignyi*, *Pelophylax bedriagae*, *Pelophylax ridibundus*, *Rana dalmatina*, and in a fish *Esox lucius* from Turkey. Morphological and anatomical features are convenient with that given by Skrjabin.

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Fig. 3. Structure of proboscis of Acanthocephalans (A: *Centrorhynchus* sp., B: *Pomphorhynchus laevis*, C: *Acanthocephalus ranae*).
In the study, *D. subclavatus* was found in the rectum of *P. ridibundus* and the infection rate is 19 %. It is the first record for Erzurum province.

Plagiorchiidae

* Dolichosaccus rastellus (Olsson, 1876) Travassos, 1930  
   **Synonym:** Distomum rastellus, Distomum endolobum, Opisthioglyphe rastellus, Opisthioglyphe histrix, Lecithopyge rastellus rastellus, Lecithopyge rastellus subulatum, Lecithopyge rastellus cylindrinforme  
   **Host:** *Rana macrocnemis*  
   **Site of infection:** intestine  
   **Geographic range:** Czechoslovakia, England, Germany, Greece, Poland, Russia, Turkey  
   **Remarks:** Adults of the *D. rastellus* is found in the intestine of the amphibians and reptiles and larvae develops in the limnid snails (Prudhoe & Bray, 1982).

* Dolichosaccus rastellus was encountered before in an ephemeropteran Cloeon dipterum (Lühe, 1909b); and in Bombina bombina (Vojtkova & Vojtek, 1975); Bombina variegata (Vojtkova & Vojtek, 1975; Sattmann, 1990); Pelophylax esculentus (Dawes, 1946; Vojtkova & Vojtek, 1975); Rana arvalis (Vojtkova & Vojtek, 1975; Ruchin et al., 2009); Rana camerani (Yildirimhan et al., 2006a; Düşen, 2007); Rana temporaria (Lühe, 1909b; Dawes, 1946; Vojtkova & Vojtek, 1975; Gassmann, 1972); Triturus alpestris (Sattmann, 1990).

* Dolichosaccus rastellus was found before in Bombina bombina and Bombina variegata (Vojtkova & Vojtek, 1975); Bufo bufo (Dawes, 1946; Vojtkova & Vojtek, 1975); Bufo calamita (Lühe, 1909b; Dawes, 1946; Vojtkova & Vojtek, 1975); Bufo viridis (Lühe, 1909b; Vojtkova & Vojtek, 1975; Chikhlyava, 2014); Bufo vulgaris (Lühe, 1909b); Hyla arborea (Vojtkova & Vojtek, 1975), Molge cristata (Lühe, 1909b); Pelobates fuscus (Ruchin et al., 2008; Ruchin et al., 2009); Pelophylax esculentus (Lühe, 1909b; Dawes, 1946; Vojtkova & Vojtek, 1975; Erhan & Gerasim, 2015; Andre, 1913; Chikhlyava et al., 2009a; Poppiolek et al., 2011; Chikhlyava et al., 2009b; Rezvantseva et al., 2010; Bjelić-Čabrilović et al., 2009; Gassmann, 1972); Pelophylax lessonae (Vojtkova & Vojtek, 1975; Popiolek et al., 2011); Pelophylax ridibundus (Vojtkova & Vojtek, 1975; Yildirimhan et al., 2005; Düşen & Öz, 2006; Popiolek et al., 2011; Koyun et al., 2015; Saeed et al., 2007; Rezvantseva, 2008; Rezvantseva, 2009; Düşen & Oğuz, 2010; Karakaş, 2015; Mashaii et al., 2000; Romanova et al., 2010; Indiryakova et al., 2012; Sattmann, 1990; Kirin & Buchvarov, 1999); Rana arvalis (Vojtkova & Vojtek, 1975; Ruchin et al., 2009); Rana dalmatina (Vojtkova & Vojtek, 1975), Rana temporaria (Lühe, 1909b; Dawes, 1946; Vojtkova & Vojtek, 1975; Andre, 1913); Triturus alpestris (Dawes, 1946); Natrix natrix (Edelényi, 1963).

* Dolichosaccus rastellus is found in the intestine of *R. macrocnemis* from Erzurum for the first time.

Opisthioelephre ranae (Frölich, 1791)

* Synonym: Fasciola ranae, Distoma endolobum, Distomum retusum, Monostomum histrix, Opisthioelephre endoloba, Opisthioelephre histrix  
* Host: Pelophylax ridibundus  
* Site of infection: intestine  
* Geographic range: Bulgaria, Czechoslovakia, England, Germany, Greece, Iraq, Iran, Hungary, Poland, Russia, Serbia, Turkey  
* Remarks: Larvae of Opisthioelephre ranae occur in Limnea stagnalis and L. palustris, adults harbour in the intestine of anurans (Dawes, 1946).

* The body is covered with spines and 3 mm long. Testes are median and disposed one behind other at about hinder a third of the body. The ovary is submedian and adjacent to the ventral sucker. Vitelline glands are located mainly lateral of caeca, extending between intestinal bifurcation to the posterior end of the body (Fig. 2d).

Haplometra cylindracea (Zeder, 1800)

* Synonym: Distoma cylindraceum, Distoma (Dicrocoelium) cylindraceum  
* Host: Rana macrocnemis  
* Site of infection: Lungs  
* Geographic range: Czechoslovakia, England, Iraq, Iran, Russia, Tatarstan, Turkey  
* Remarks: Haplometra cylindracea is a common parasite of the lung of frogs throughout Europe and Northern Asia, larvae develop in the snails (Prudhoe & Bray, 1982).

* The spinosus body is almost 8 mm in length. Testes are large and located at the posterior third of the body. The uterus occupies most of the area between the intestinal caeca and extends to the posterior end of the body. Vitelline follicles are located between intestinal bifurcation and hinder the margin of the posterior testis (Fig. 2h).
et al., 2006a; Düşen, 2007); Rana dalmatina (Vojtkova & Vojtek, 1975; Yildirimhan et al., 2016); Rana lessonae (Vojtkova & Vojtek, 1975); Rana macrocnemis (Düsen, 2007); Rana macrocnemis pseudodalmatina (Masahaii et al., 2008); Rana tavaranesi (Düsen, 2012); Rana temporaria (Lühe, 1909b; Dawes, 1946; Vojtkova & Vojtek, 1975; Gurtt, 1845; Andre, 1913; Linstow, 1878; Gassmann, 1972).

All the characteristic features are the same as those given by Skrjabin (1958). Haplotrema cylindracea is the first record for Rana macrocnemis from Erzurum.

**Haematoloechus variegatus** (Rudolphi, 1819)

**Synonym:** Distoma variegatus, Distoma variegatum, Pneumonoeces variegatus

**Host:** Pelophylax ridibundus

**Site of infection:** Lungs

**Geographic range:** Czechoslovakia, England, Germany, Poland, Russia, Serbia, Tatarstan, Turkey

**Remarks:** Adults of Haematoloechus variegatus are found in the lungs of the various terrestrial anurans and larvae can be found in freshwater snails of all zoogeographical regions (Prudhoe & Bray, 1982).

The body is non-spinous and almost 1 cm. Ventral sucker is smaller than oral sucker and situated in front of the mid-body. Testes are ovoid and situated side by side in the third quarter of the body. The ovary is ovoid and situated in front of the testes. Vitelline glands extend as ten to twelve rosette-like groups of six to seven follicles on each side from the level of the oesophagus almost to the posterior extremity. The uterus is irregularly folded in front of the gonads and extends between the testes and the posterior extremity (Fig. 2). It was found in Bombina bombina and Bombina variegata (Vojtkova & Vojtek, 1975); Bufo bufo (Dawes, 1946); Bufo viridis (Vojtkova & Vojtek, 1975; Chikhlyaev, 2014); Pelobates fuscus (Ruchin et al., 2008); Pelophylax esculentus (Lühe, 1909b; Dawes, 1946; Walton, 1949; Vojtkova & Vojtek, 1975; Erhan & Gherasim, 2015; Gurtt, 1845; Andre, 1913; Chikhlyaev et al., 2009a; Popiolek et al., 2011; Chikhlyaev et al., 2009b; Rezvantseva et al., 2010; Bjelić-Čabriolo et al., 2009; Gassmann, 1972); Pelophylax lesso­nae (Vojtkova & Vojtek, 1975; Popiolek et al., 2011); Pelophylax ridibundus (Walton, 1949; Vojtkova & Vojtek, 1975; Popiolek et al., 2011; Sağlam & Arkan, 2006; Rezvantseva, 2008; Rezvantseva, 2009; Indiryakova et al., 2012); Rana arvalis (Vojtkova & Vojtek, 1975; Ruchin et al., 2009); Rana temporaria (Dawes, 1946; Vojtkova & Vojtek, 1975).

The main differences between the Skrjabinoeces and Haematoloechus genera are the number and location of the vitelline glands. The vitelline glands of genus Skrjabinoeces is located at the mid-body, but the glands of genus Haematoloechus lays between laterally intestinal bifurcation and hind-body (Skrjabin, 1962). All the taxonomic characters of the species are convenient with that given by Skrjabin (1962). Haematoloechus variegatus is found in many countries of Asia and Europe including Turkey but it has not been recorded before in Erzurum province so far.

**Skrjabinoeces breviana** (Loss, 1899) Sudarikov, 1950

**Synonym:** Haematoloechus breviana

**Host:** Pelophylax ridibundus

**Site of infection:** Lungs

**Geographic range:** Iran, Russia, Turkey, Ukraine

**Remarks:** Skrjabinoeces sp. lives in the lungs of frogs and toads (Prudhoe & Bray, 1982). The body is 5.5 mm and covered with spines. Testes are located at the posterior third of the body. Ascending and descending limbs of the uterus occupy between the caeca. Large follicles of vitelline glands extend laterally between the ventral sucker and fore-testis (Fig. 2g).

Skrjabinoeces breviana was recorded before in Pelophylax esculentus (Kovalenko, 2007); Pelophylax bedriagae (Demir et al., 2015); Pelophylax ridibundus (Yildirimhan et al., 2005; Düsen & Öz, 2006; Koyun et al., 2015; Düsen & Oğuz, 2010; Karakaş, 2015; Mashaii et al., 2000; Romanova et al., 2010; Indiryakova et al., 2012; Kovalenko, 2007). Morphological and anatomical characteristics of Skrjabinoeces breviana are the same as those given by Skrjabin (1962). S. breviana has been recorded in P. ridibundus from Erzurum for the first time.

**Skrjabinoeces similis** (Loss, 1899)

**Synonym:** Haematoloechus similis, Haematoloechus similegenus, Distoma simile, Distoma variegatum, Pneumonoeces similis, Pneumonoeces similegenus.

**Host:** Pelophylax ridibundus

**Site of infection:** Lungs

**Geographic range:** Bulgaria, Czechoslovakia, England, Germany, Italy, Iraq, Iran, Russia, Swiss, Tatarstan

**Remarks:** Skrjabinoeces similis is found in the lung of the frog and toads, larvae develop in the planorbid snails (Prudhoe & Bray, 1982).

The body is covered with spines and 13 mm long. Ventral sucker is smaller than oral sucker and located at mid-region of body. Testes are ovoid, and the ovary is located near the ventral sucker. Vitelline glands are disposed of large follicles, ranging laterally from the anterior of the ventral sucker to the anterior testis (Fig. 2). Skrjabinoeces similis was encountered in Bombina bombina (Vojtkova & Vojtek, 1975); Pelophylax esculentus (Lühe, 1909b; Dawes, 1946; Vojtkova & Vojtek, 1975; Mashaii et al., 2000); Pelophylax ridibundus (Vojtkova & Vojtek, 1975; Andre, 1913; Chikhlyaev et al., 2009a; Chikhlyaev et al., 2009b; Rezvantseva et al., 2010; Saeed et al., 2007; Rezvantseva, 2008; Rezvantseva, 2009; Romanova et al., 2010; Indiryakova et al., 2012; Mashaii et al., 2008; Buchvarov & Irikov, 1997); Rana arvalis (Ruchin et al., 2009); Rana temporaria (Dawes, 1946).
recorded in Turkey. It is the first record for Erzurum province and parasite fauna of Turkey.

Acanthocephala

Echinorhynchidae

Acanthocephalus ranae (Schrank, 1788) Lühe, 1911

Synonym: Echinorhynchus ranae

Host: Pelophylax ridibundus, Rana macrocnemis

Site of infection: intestine

Geographic range: Brazil, Bulgaria, Germany, Greece, Hungary, Poland, Romania, Russia, Serbia, Swiss, Turkey, USA

Remarks: Acanthocephalus ranae lives in the intestine of some frogs and newts generally in Europe and the larva is parasitic in Asellus aquaticus (Lühe, 1911).

Asellus aquaticus was encountered before in Anguis fragilis (Shimalov et al., 2000); Asellus aquaticus (Lühe, 1911); Bombina bombina (Lühe, 1911); Bufo bufo (Gassmann, 1972; Yildirimhan & Karadnez, 2007; Düsen, 2011; Heckmann et al., 2011); Bufo viridis (Karaaş, 2015; Lühe, 1911; Yildirimhan, 1999); Bufo vulgaris (Lühe, 1911); Coronella austriaca (Edelényi, 1963); Diemyctylus viridescens (VanCleave, 1922); Hyla arborea (Heckmann et al., 2011), Hyla orientalis (Düsen & Yaka, 2014; Yakar et al., 2016); Molge cristata (Lühe, 1911); Molge vulgaris (Lühe, 1911); Natrix natrix (Edelényi, 1963); Pelophylax esculentus (Andre, 1913; Popołek, 2005); Pelophylax lessonae (Popołek et al., 2011); Pelophylax bedriagae (Demir et al., 2015); Pelophylax ridibundus (Yildirimhan et al., 2005; Düsen & Öz, 2006; Popołek et al., 2011; Koyun et al., 2015; Sağlam & Ankan, 2006; Düsen & Oğuz, 2010; Karakaş, 2015; Oğuz et al., 1994; Sattmann, 1990; Buchvarov & Iriko, 1997; Heckmann et al., 2011; Iacob, 2021); Rana camerana (Yildirimhan et al., 2006a); Rana dalmatica (Düsen et al., 2009; Yildirimhan et al., 2016). (Heckmann et al., 2011); Rana macrocnemis (Yildirimhan et al., 1997a), (Düsen, 2007), (Heckmann et al., 2011); Rana temporaria (Heckmann et al., 2011; Düsen, 2012); Rana tavarosensis (Heckmann et al., 2011; Düsen, 2012); Rhinellaicterica (Pilati et al., 2013).

A. ranae, which was found formerly in urodeles and anurans from the countries of Europe, Asia and America have been found in some provinces of Turkey, but it is the first record for Erzurum province.

Centrorhynchidae

Centrorhynchus sp. Lühe 1911

Synonym: Centrhorhynchus; Centrhomysoma; Gordiorhynchus; Paradoxites; Travassosina.

Host: Pelophylax ridibundus

Site of infection: intestine

Geographic range: Bulgaria, Porto Rico, Turkey

Remarks: Adults of the acanthocephalan genus Centrorhynchus (Polymorphida: Centrorhynchidae) occur primarily in birds of prey (Richardson & Nickol, 1995).

The trunk is non-spinous and slender. The proboscis is divided into two regions and the anterior swollen region has 8 hooks per 26–28 rows, the posterior region has 3–4 hooks per 26–28 rows. Testes are in the anterior portion of the trunk (Fig. 3a).

Centrorhynchus sp. was recorded before in Eupsophus sp. (Torres & Puga, 1996); Herpestes javanicus auropunctatus (Cable & Quick, 1954); Pelophylax ridibundus (Yildirimhan et al., 2005). While it was found only one individual in P. ridibundus from Istanbul formerly by Yildirimhan et al. (2005), Centrorhynchus sp. is the first record for Erzurum province.

Pomphorhynchidae

Pomphorhynchus laevis (Zoega in Müller, 1776) Van Cleave, 1924

Synonym: Echinorhynchus laevis; Echinorhynchus tereticollis; Pomphorhynchus tereticollis; Echinorhynchus proteus; Pomphorhynchus proteus; Pomphorhynchus intermedius.

Host: Pelophylax ridibundus

Site of infection: intestine

Geographic range: Iraq, Turkey

Remarks: Species of Pomphorhynchus are largely parasites of freshwater fishes (Amin et al., 2003).

The trunk is non-spinous and spindle-shaped. We recorded at 2010 P. spindletregruncatus from some freshwater fish of Erzurum province and marsh frogs of Isparta province (Heckmann et al., 2010). The difference of P. laevis from P. spindletregruncatus is mainly the number of the proboscis' hooks. The proboscis of P. spindletregruncatus is ovoid and 15–18 longitudinal rows of 7–9 hooks of each and proboscis of P. laevis cylindrical to ovoid, with 16–18 longitudinal rows of 11–12 hooks of each. The neck is moderate length and has a distal bulb (Fig. 3b).

P. laevis was recorded in freshwater fishes as Abramis brama, Abramis sapa, Acioperus ruthenus, Alburnus albumus (Nedeva et al., 2003); Alburnus baliki (Aydoğdu et al., 2011); Anguilla anguilla (Sures, 2001); Apollina melanostoma (Kvach & Skora, 2007; Rolbiecki, 2006; Ondrackova et al., 2005); Aspius aspius (Nedeva et al., 2003); Barbus barbus (Nedeva et al., 2003); Schledermann et al., 2003; Laimgruber et al., 2005; Brown et al., 1986; Thieten et al., 2004); Blicca bjorkna and Carassius auratus gibelo (Nedeva et al., 2003); Crenilabrus tinca (Akmirza, 2002); Cyprinus carpio (Buhurcu, 2006); Gobius niger (Zander, 2004); Gymnocephalus chentrorhynchus; Lota lota, Neogobius cephalarges, and Plecosculus euthymus (Nedeva et al., 2003); Neogobius fluvitilis and Neogobius kessleri (Ondrackova et al., 2005); Neogobius iliini (Mineeva, 2013); Percus fluvitilis (Sobecka & Słomińska, 2007), (Nedeva et al., 2003); Phoxinus phoxinus (Kralova-Hromadova et al., 2003; Dudiňák & Šnábel, 2001); Platychthys flesus (Koie, 1999), (Chib-
Caught Near Gökçeada.

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Conflict of Interest

The authors state no conflict of interest.

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